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FOREST INSECT CONDITIONS IN THE UNITED STATES 1968

FOREST SERVICE

UNITED STATES
DEPARTMENT OF
AGRICULTURE

Foreword

This is the 19th annual report on the scope, severity, and trends of the more important forest insect infestations in the United States, and the programs undertaken to check resulting damage and loss. It is compiled primarily for public and private forest land managers to keep them informed of insect conditions on their and neighboring lands. Judging from the many requests, the report is also useful to students and others interested in forest entomology. Volumes kept over the years have served as useful historical records of insect population trends and occurrences of outbreaks.

An effective forest pest control program requires responsible administration and sound technology to discover and evaluate outbreaks. Some 480 million acres of forest land were examined during 1968 by Federal and State Pest Control personnel, both from the air and on the ground, to detect and assess the forest pest situation. During the year, 26 States participated in the program to share costs of forest pest survey and evaluation work on non-Federal lands.

Action continued on developing and implementing control techniques that place less reliance on the use of chemicals. Pilot studies of promising non-persistent pesticides were conducted. Biological and cultural controls were used where possible. Sanitation-salvage sales were employed where possible to alleviate problems caused by bark beetles and other pests, and to salvage some of the timber mortality. About 525,000 parasites of the larch casebearer were released at 105 sites in western Montana. In a joint effort by Forest Service Research and Forest Pest Control personnel, an additional supply of a virus lethal to European pine sawfly was produced to test its effectiveness against the sawfly and its safety to man and the environment.

Forest Service engineers further refined the bi-fluid Freon spray system developed last year. The system will produce droplets approaching 50 microns MMD (mass median diameter) with a maximum droplet size of 120 microns. The system employs Freon, insecticide, and carrier pressurized in a tank by introducing nitrogen gas. As the spray mixture is forced from the boom nozzles, the Freon expands many times in volume exploding the insecticide into a fine aerosol mist. As designed for and installed on a C–47 aircraft, the spray system was satisfactorily field tested in 1968. Specifications will be available soon.

Grateful acknowledgment is made to all Federal, State, county, and private agencies whose assistance and cooperation made this report possible. Comments are welcomed.

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This publication reports research involving pesticides. It does not contain recommendations for their use, nor does it imply that the uses discussed here have been registered. All uses of pesticides must be registered by appropriate State and/or Federal agencies before they can be recommended.

CAUTION: Pesticides can be injurious to humans, domestic animals, desirable plants, and fish or other wildlife—if they are not handled or applied properly. Use all pesticides selectively and carefully. Follow recommended practices for the disposal of surplus pesticides and pesticide containers.

The use of trade, firm, or corporation names in this publication is for the information and convenience of the reader. Such does not constitute an official endorsement of any product or service by the U.S. Department of Agriculture to the exclusion of others which may be suitable.

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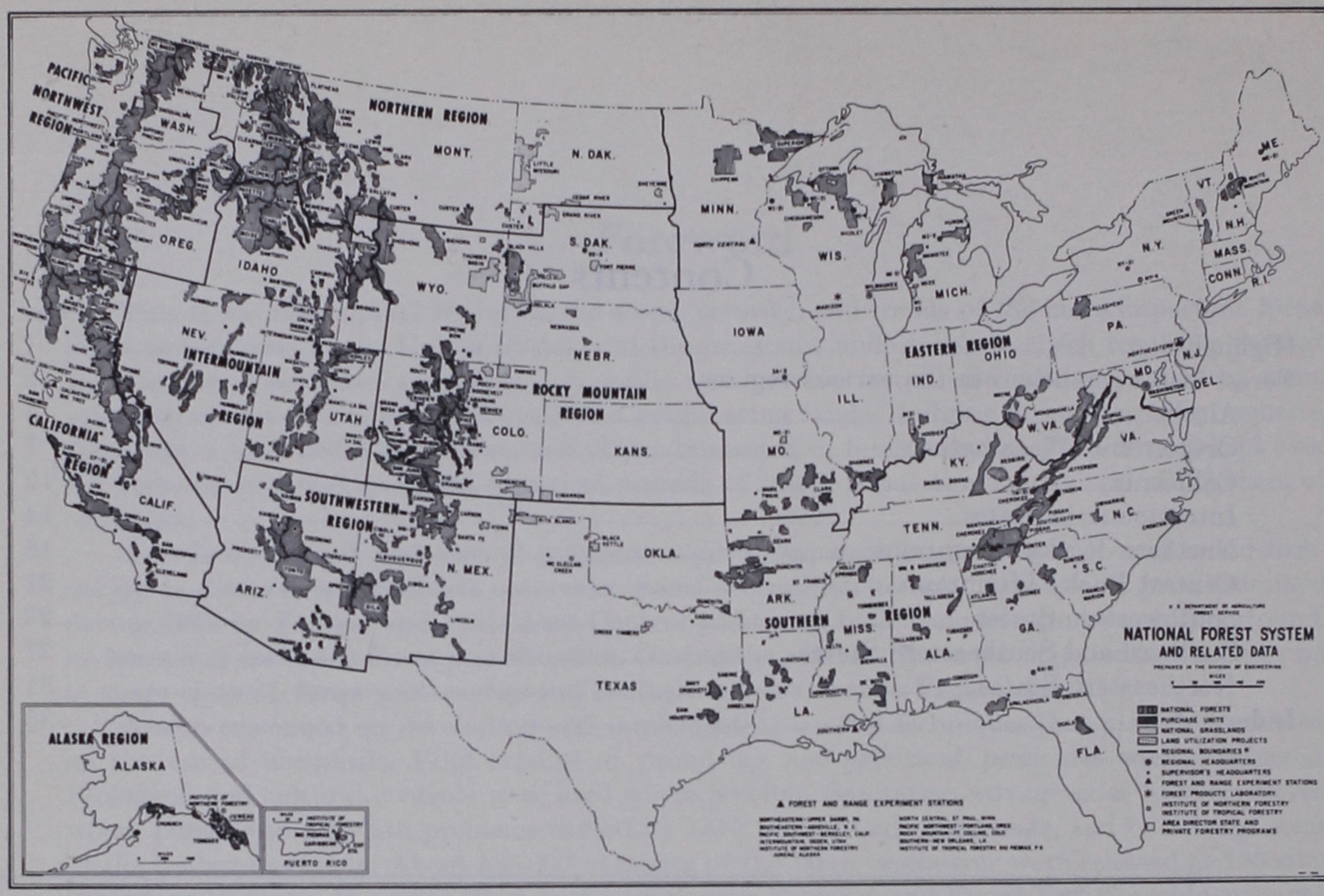

Forest Pest Control work is being carried on at the following locations:

USDA Forest Service
Federal Building
Missoula, Mont. 59801

USDA Forest Service
Federal Center Building
Denver, Colo. 80225

USDA Forest Service
Federal Building
517 Gold Avenue S.W.
Albuquerque, N. Mex. 87101

USDA Forest Service
Federal Office Building
324 25th Street
Ogden, Utah 84401

USDA Forest Service
630 Sansome Street
San Francisco, Calif. 94111

USDA Forest Service
P.O. Box 3623, P
Portland, Oreg. 97208

USDA Forest Service
6816 Market Street
Upper Darby, Pa. 19082

USDA Forest Service
29 Cottage Street
Amherst, Mass. 01002

USDA Forest Service
W. Larpenteur Avenue
St. Paul, Minn. 55101

USDA Forest Service
P.O. Box 365
Delaware, Ohio 43015

USDA Forest Service
P.O. Box 5895
Asheville, N.C. 28803

USDA Forest Service
2500 Shreveport Highway
Alexandria, La. 71360

USDA Forest Service
50 Seventh Street NE
Atlanta, Ga. 30323

USDA Forest Service
Federal Office Building
P.O. Box 1628
Juneau, Alaska 99801

HIGHLIGHTS

Situation in the Western States

All reports indicate that bark beetle damage was again the major problem confronting forest managers in the West. Mountain pine beetle still predominated in the Intermountain States with heavy infestations continuing to deplete lodgepole pine forests of eastern Idaho and western Wyoming. However, the widespread infestations on the Teton National Forest, Wyo., continued to decline. On the Targhee National Forest, Idaho, infestations collapsed from natural causes in some areas and built up in others. In the Northern and Central Rockies, this insect caused damage to ponderosa and white pine as well as lodgepole.

A number of other bark beetles were active in western forests. For example, Douglas-fir beetle damage in 1968 was the highest recorded in recent years in Oregon and Washington; in the Southwest and Intermountain States, Engelmann spruce beetle is now a potential threat to a vast acreage of mature spruce; California has an epidemic of western pine beetle.

Forest defoliators also caused concern. Among these were budworms, needle miners, and casebearers. The most significant areas of budworm activity were in the Central Rockies, in Idaho, and in western Montana. Larch casebearer and needle miners were found in increasing numbers in Oregon and Washington and in the Northern Rocky Mountain States.

In Alaska, the Sitka spruce beetle remained at epidemic levels on the Kenai Peninsula despite control efforts using both trap-trees and chemicals. A new infestation developed near Hyder in southeastern Alaska, and two old infestation centers in the south central part became active again. Defoliation by the large aspen tortrix was common throughout the interior. Hundreds of acres were completely defoliated in the Fairbanks and Glennallen areas. Hemlock sawfly populations declined sharply.

Hot, dry weather in the summer of 1967 contributed to an upsurge in all bark beetle activity in Oregon and Washington. Douglas-fir bark beetle damage caused the loss of a billion board feet of timber. Greater populations of western pine and Engelmann spruce beetle, pine engraver, and fir engraver emerged and were destructive. Among the defoliators, the larch casebearer, the western hemlock looper, and needle miners were reported in increased numbers.

At present, the most pressing problem in California is an epidemic of western pine beetle in young-growth pine near McCloud. Localized outbreaks of other bark beetles—such as fir engravers, mountain pine beetles, Douglas-fir beetles—occurred but did not reach epidemic dimensions. The California flatheaded borer continued to destroy Jeffrey pine in the southern part of the State. Jeffrey and lodgepole pine in El Dorado County suffered from a pine needle scale infestation. Damage from defoliating insects was minor.

Mountain pine beetle in lodgepole pine was the main problem in the Intermountain States. The long-standing epidemic on the Teton National Forest which started to decline in 1967, continued to lessen. On a non-control area of the Targhee National Forest, beetle populations were reduced by natural factors. In another area, chemical control reduced tree killing and slowed the beetle's migration into adjoining beetle-free stands. In a third area, some tree-killing occurred when a control program was abandoned. Infestations increased on the Bridger National Forest and Yellowstone National Park, Wyo. There was some slight buildup in mountain pine beetle populations in ponderosa pine throughout the entire Intermountain Region. In 1968, spruce budworm-infested areas broadened, the largest increases being on the Payette and Bridger National Forests. Engelmann spruce beetle also increased generally in portions of southern Idaho and western Wyoming, but most other bark beetles and defoliators remained about as they were in 1967.

The Northern Rockies experienced a general upsurge of both defoliators and bark beetles. Mountain pine beetle caused losses in mature lodge-

pole, ponderosa, and white pine stands, particularly in the Kaniksu National Forest, Idaho, and along the foothills of the Big and Little Snowy Mountains, Mont. Unburned slash and windthrown Engelmann spruce trees in the Flathead National Forest, Mont., contributed to a severe outbreak of spruce beetle there. In 1968, an epidemic of spruce budworm covered a total of 4.2 million acres of Douglas-fir and true fir forests in Idaho and western Montana. Spruce budworm and fir coneworm destroyed a large amount of Douglas-fir seed in some areas of Montana. Larch casebearer spread through larch stands in western Montana, northern Idaho, and eastern Washington, and was discovered for the first time in Glacier National Park, Mont.

The most important insect pest of the Central Rockies was the Black Hills beetle which increased in numbers on the Black Hills, Roosevelt, and San Juan National Forests. More than a quarter of a million acres are now infested. Engelmann spruce beetle populations were low, but were still a threat to overmature Engelmann spruce in Colorado and Wyoming. Areas of spruce budworm defoliation broadened but damage did not increase, and no suppression is planned.

Throughout the Southwest, Engelmann spruce beetle populations showed a trend toward epidemic proportions. On the Santa Fe National Forest, N. Mex., these beetles emerged from scattered blowdown and attacked standing trees. There were other currently active Engelmann spruce beetle centers on the Carson National Forest, N. Mex., and on the Apache National Forest, Ariz.

Situation in Southern and Southeastern States

Bark beetles were the major concern in the South and Southeast with the southern pine beetle again the most important pest. Populations were abundant in Louisiana, and new outbreaks occurred in the coastal plains of North Carolina and in the Great Smoky Mountains National Park. In Texas, pine losses were the greatest since 1962. The outlook improved in Mississippi, Alabama, South Carolina, and Virginia where southern pine beetle numbers declined. The black turpentine beetle, which infested stumps and residual trees in logging areas of Louisiana, Mississippi, and Texas in 1967, subsided to a point where chemical control is now not necessary. Drought contributed to a buildup of engraver beetles in several areas. New infestations of balsam woolly aphid appeared in the Fraser fir forests of the southern Appalachians. Sawflies, fall webworm, and a variety of nuisance pests were evident in many localities.

Situation in the Lake and Central States and the Northeast

Spruce budworm remained a major problem in the Northeastern States. In Minnesota, about 500,000 acres of spruce-fir type are infested. Control may be needed in some recreation areas in 1969. The budworm remained active on over 80,000 acres near Oxbow, Maine. Except in lower Michigan, jack-pine budworm populations were static in the Lake States. Outbreaks of pine tussock moth are recurring in Minnesota and Wisconsin. Saratoga spittlebug populations are increasing in those two States and also in Michigan and Maine. Damage by balsam woolly aphid continued in the fir stands of northern New England. The fall cankerworm-oak leaf tier complex defoliated over a million acres of oak in Pennsylvania, New Jersey, and West Virginia. A complex of oak leaf rollers damaged red oaks over a 360-square mile area in lower Michigan. Saddled prominent again heavily defoliated hardwoods from the Lake States to New England. A disease reduced saddled prominent populations in Pennsylvania and upper Michigan; however, this insect is expected to increase in some areas of New York in 1969. The forest tent caterpillar continued to defoliate large acreages of aspen in Minnesota and Michigan. Beech scale moved into Massachusetts and New York causing mortality to sawtimber-size stands. Hardwood borers continue to damage oaks from Maryland to Missouri. The annual loss caused by these insects in Missouri is estimated at $2,000,000.

Suppression Activities

Continuing the trend of the past few years, bark beetles were the major target of control efforts in the Nation during 1968. Although the direct control effort against the mountain pine beetle in lodgepole pine stands of the Intermoun-

tain West was reduced, it remained the largest bark beetle project in the country. Studies and continuous assessments of the direct frontal attack on this outbreak have led to realignment to emphasize salvage and harvest. In the future, less dependence will be placed on a direct control program.

In the South and Southeast, the Forest Service joined with the States of North Carolina, Mississippi, Louisiana, and Texas in efforts to suppress the destructive southern pine beetle on Federal, State, and private forested lands. At year's end, timely salvage logging, cutting and burning, or chemically treating infested trees had resulted in good control on all areas except in Texas and parts of Louisiana.

Only a minor amount of control work was needed on other bark beetles during the year. Outbreaks of Douglas-fir beetle, spruce beetle, western pine beetle, and mountain pine beetle in ponderosa pine were handled by salvage and commercial thinning sales with minimum reliance on chemical treatment.

Control projects to suppress defoliating insects involved less acreage in 1968 than in other recent years. Only about 33,500 acres were sprayed, and of this total over 17,000 acres were treated in pilot control studies. One study (in cooperation with the Maine Forest Service) was made to evaluate the effectiveness of the insecticide Sumithion against the spruce budworm. The results were not satisfactory.

Zectran, the carbamate that shows promise as a replacement for DDT for budworm control, was again tested in 1968 in Montana. The non-persistent chemical was applied at the rate of 1 ounce in a 1 pint of carrier per acre. The spray was applied by a C–47 aircraft equipped with the aerosol spray system developed by Forest Service engineers. Control results were unsatisfactory but, this was not considered due to the ineffectiveness of the insecticide. Plans are to retest Zectran in 1969 at a dosage rate of 2.4 ounces in one-half gallon of carrier.

Thorough and timely evaluations of jack-pine budworm outbreaks on National Forests in northern Michigan and Wisconsin led to the cancellation of a 174,000-acre aerial spray project, based mainly on a last minute natural reduction of the budworm population.

In other suppression activities, new outbreaks of pine shoot moth in eastern Washington and eastern Oregon were handled by both spraying and destruction of infested trees. Pine reproduction on 1,200 acres of the Coconino National Forest, Ariz., was aerially treated with dimethoate to prevent damage by the southwestern pine tip moth. A grasshopper infestation in young pine plantations on Mt. Shasta in northern California was aerially treated with malathion. The Agricultural Research Service handled this 4,200 acre project. Saratoga spittlebug was successfully controlled on 1,000 acres in Maine and on 1,900 acres in Wisconsin and upper Michigan. Additional cooperative projects included whitepine weevil control in New York, larch sawfly in Maryland, European pine sawfly in Pennsylvania, Nantucket pine tip moth in Missouri, and pine tortoise scale control in Wisconsin.

Pest suppression projects are summarized in the following tabulation:

Pest Control Accomplishments in the United States, 1968

Insect and location	*Trees treated*	*Acres sprayed*
Southern pine beetle—South and Southeast	266, 104	----------
Black turpentine beetle—South and Southeast	40, 431	----------
Black Hills beetle—Colorado, South Dakota, Wyoming	17, 555	----------
Mountain pine beetle—Idaho, Wyoming, Utah	474, 974	----------
White-pine weevil—New York	483, 600	----------
Saratoga spittlebug—Wisconsin	111, 750	----------
Balsam woolly aphid—North Carolina	26, 255	----------
Spruce budworm—Idaho and Maine	----------	33, 560
Bark beetles [1]—California, Oregon, Washington	45, 606	----------
Miscellaneous—Entire United States	8, 413	4, 115
Total	1, 474, 588	37, 675

[1] Reported in various combinations of western pine beetle, mountain pine beetle, Jeffrey pine beetle, ips, flatheaded borers, etc.

FOREST INSECT CONDITIONS IN THE VARIOUS REGIONS

ALASKA

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Conditions in Brief

The outbreak status of two forest insects continued to cause concern in Alaska. The spruce beetle remained at epidemic levels on the Kenai National Moose Range and on portions of the adjacent Chugach National Forest on the Kenai Peninsula. A new infestation occurred on the Salmon River in southeastern Alaska near Hyder. Two old infestations located in the Caribou Creek and the Tonsina River drainages of south central Alaska became active again. A combination trap-tree and direct control project was undertaken on a portion of a 1,200-acre infestation on the Chugach National Forest. Salvage logging is being used to control the outbreak near Hyder. Additional trap-tree and salvage logging will be used to control beetle populations on portions of the Chugach National Forest in 1969.

The large aspen tortrix was active over much of interior Alaska causing severe defoliation in the Fairbanks and Glennallen areas. A decrease in this epidemic is expected in 1969.

A sharp decline in hemlock sawfly defoliation was observed throughout southeastern Alaska. Egg and pupal counts indicate a significant decrease in sawfly numbers in all areas sampled. An extremely high incidence of pupal parasitism was observed in one area near Sitka. Samples of diseased cocoons taken from widely scattered areas in the panhandle contained the resting spores of an Entomophthorales fungus.

Black-headed budworm populations remained very low for the fourth season. Egg surveys revealed active populations at only two locations in southeast Alaska. Indications are that this pest will remain endemic again in 1969. No projects were undertaken to control defoliating insects during the past year.

Status of Insects

Sitka spruce beetle, *Dendroctonus obesus* (Mann.) This beetle has continued to be the most serious insect enemy of white and Sitka spruce in Alaska. An infestation spreading over several thousand acres in the Chickaloon Bay-Pt. Possession and Kenai-Soldotna areas continued to cause epidemic losses of white spruce on the Kenai National Moose Range in south central Alaska. This infestation, triggered by road building, pipeline construction, and general land clearing for petroleum exploration, has persisted for several years and is expected to continue in 1969. No control is being considered at this time.

Areas of chronic infestation were observed at various locations on the Kenai and Anchorage Ranger Districts of the Chugach National Forest, but no new outbreaks were recorded. A 400-acre "hot spot," within a 1,200 acre infestation in the Granite Creek-East Fork drainage of the Anchorage Ranger District, was treated in 1968. Treatment included the use of both trap-tree and chemical control methods. Increased tree killing occurring within the untreated portions of this general infestation in 1968 indicates a need for additional control. Planned treatment for 1969 includes trap-tree placement, district control with chemicals, and salvage logging. Two old infestations became active again in interior spruce stands. Tree killing was observed in a 200-acre area along Caribou Creek, Mile 108 of the Glenn Highway. This infestation, apparently a result of general flooding, is expected to continue in 1969. Increased tree killing in scattered, over-mature white spruce was observed along the east side of the Tonsina River near Stuart Creek. These infestations will be kept under periodic surveillance. No control is recommended.

Extensive killing of river bottom Sitka spruce has been caused by the spruce beetle along a 5-mile stretch of the Salmon River at the head of Portland Canal. Violent flooding from the dumping of glacier fed Disappearing Lake deposited much sand and gravel over tree roots on bottom land, and outbreak populations of bark beetles developed in the weakened trees. Salvage logging has been employed to control this outbreak.

Large aspen tortrix, *Choristoneura conflictana* (Wlk.). Populations of this pest were common throughout the interior of Alaska for the third consecutive season. Stands of quaking aspen, and to some extent balsam poplar and alder (from Chatanika south to Chickaloon on the Glenn Highway and east to Chicken, north of Tetlin Junction on the Alaska Highway), sustained varying degrees of defoliation. Especially heavy defoliation, resulting in the total destruction of foliage complement, occurred for the second year over many hundreds of acres in both the Fairbanks and the Copper Center-Glennallen areas. Widespread starvation of four-fifth instar larvae and an increase in parasitism in these areas indicate that a significant reduction in population is occurring. A decrease in both the extent and intensity of defoliation is expected to occur within the general infestation in 1969. Except for possible treatment of a few valuable recreation areas, no control is contemplated.

Hemlock sawfly, *Neodiprion tsugae* Midd. A sharp decline in sawfly populations was observed in most infestation centers sampled on both the North and South Tongass National Forests in 1968. The persistent infestation on Peril Strait near Todd completely collapsed, leaving in its wake appreciable top-killing and tree mortality. A study will be made in 1969 to determine the impact of the prolonged defoliation on the stands in this area. A potentially serious infestation on State and private lands near Sitka did not materialize. Apparently, reduced fecundity brought on by starvation, coupled with unusually high pupal parasitism, brought about the decline.

Areas of medium to heavy defoliation observed on the west and northwest side of Kupreanof Island and adjacent Kuiu Island, the northern and west central portions of Prince of Wales Island, and adjacent Kosciusko Island in 1966–67 have mostly subsided. Egg and pupal samples taken during a fall survey indicate that sawfly populations are declining and should cause no damage in 1969. Analysis of samples of sawfly cocoons sent to the Foresty Sciences Laboratory at Corvallis, Oreg., revealed the presence of resting spores of an Entomophthorales fungus. It is assumed that this pathogen played an important role in the decline of sawfly populations in these areas.

The noticeable, but very light, defoliation observed on Tuxekan Island, at a few widely scattered locations on Prince of Wales Island, on several small islands in Trocadero Bay, and at Coco Harbor on Dall Island is expected to remain at its present level in 1969. Significant damage to host trees is not expected next year.

Black-headed budworm, *Acleris variana* (Fern.). Budworm populations in southeast Alaska remained low for the fourth season. Results of egg surveys revealed populations at only two sample areas. Egg counts taken at Tuxekan village on the west side of Prince of Wales Island and on nearby Tuxekan Island indicate that these populations will remain endemic. No damage is expected to result from this insect in 1969.

Western hemlock looper, *Lambdina fiscellaria lugubrosa.* (Hulst). The western hemlock looper epidemic reported in the Bradfield River drainage in 1965 appears to have completely subsided.

Redwood bark beetle, *Phloeosinus sequoiae* Hopk. Tree killing by this insect, common throughout the range of western red and Alaska yellow cedar, was especially concentrated on the South Tongass National Forest. Localized infestations, totaling several thousand acres, were observed from Frederick Sound south to the Boca de Quadra. Tree killing is expected to continue in 1969.

Unknown bud moth. A bud moth, tentatively identified as *Zeiraphera* sp., was present in noticeable numbers on white spruce stands over a sizeable acreage on the Kenai Peninsula. Heavy damage was observed on sapling and pole-size trees from Divide to Bear Lake on the Grouse Creek drainage near Seward, Alaska. Light damage was observed on mature white spruce in the Granite Creek drainage on the Anchorage Ranger District. A continuation of this infestation is expected in 1969.

OREGON and WASHINGTON

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Conditions in Brief

Forest insect damage occurred on nearly 3 million acres of forest land in Oregon and Washington during 1968. Bark beetles were the most-damaging insects, while defoliators were the most widespread. Damage level from the Douglas-fir bark beetle was one of the most severe recorded in recent years. Practically all bark beetle damage showed an upward trend. The prolonged drought and high temperatures during the summer of 1967 contributed to population increases.

The trend in defoliators was mixed. Sawflies,

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Foresters examine gallery patterns of Douglas-fir beetle on trees being salvaged from a beetle infested area of the Gifford Pinchot National Forest, Wash.

budworms, and tent caterpillars were decreasing, while the larch casebearer, western hemlock looper, and needle miners on pines were all increasing.

Status of Insects

Douglas-fir beetle, *Dendroctonus pseudotsugae* Hopk. This bark beetle killed about 1 billion board feet of Douglas-fir timber on 255,770 acres in Oregon and Washington. Most severe losses were on the west side of the Cascade Mountains.

Areas of concentrated tree killing were in the Baker River drainage of the Mt. Baker National Forest and in the Wind River and Little White Salmon River drainages of the Gifford Pinchot National Forest, Wash. In Oregon, heavy losses occurred in the Clackamas River drainage of the Mt. Hood National Forest and in the Rogue and Umpqua River drainages in the southwestern part of the State.

Damage is expected to remain high next year. Removal of beetle-infested trees is progressing as rapidly as possible, but many heavily infested areas are still unroaded. A test of the trap tree method of control is planned for the coming winter and spring on the Gifford Pinchot National Forest in Washington.

Mountain pine beetle, *Dendroctonus ponderosae* Hopk.=(*D. monticolae Hopk.*). Losses in the lodgepole pine stands of eastern and central Oregon increased sharply over the past year. Most severe losses occurred on the Deschutes, Fremont, Umatilla, Wallowa-Whitman, and Winema National Forests. Tree killing in Washington increased also with heaviest losses on the Colville National Forest.

Tree killing in stagnated, pole-size ponderosa pine stands increased only slightly. Heaviest losses in Oregon were in the Sumpter Valley on the Wallowa-Whitman National Forest. In Washington, heaviest losses were on the Wenatchee and Okanogan National Forests and the Yakima Indian Reservation. Other important losses occurred on the Fremont, Deschutes, Malheur, and Mt. Hood National Forests in Oregon and on the Colville National Forest and Colville Indian Reservation in Washington.

Infestations in western white pine decreased. Most losses were near the crest of the Cascade Mountains in both Oregon and Washington.

Mountain pine beetle activity in the sugar pine stands of southwest Oregon was substantially reduced from last year.

Western pine beetle, *Dendroctonus brevicomis* LeC. Outbreaks in mature ponderosa pine increased in both Oregon and Washington. Most tree killing in Oregon occurred on the Deschutes, Fremont, Malheur, and Ochoco National Forests and the Warm Springs Indian Reservation. In Washington, losses were centered in the Klickitat River drainage in the south central part of the State. The hot, dry summer of 1967 probably added substantially to this population buildup. Populations are expected to remain static or down slightly in 1969.

Engelmann spruce beetle, *Dendroctonus obesus* (Mann.) = (*D. englemanni* Hopk.). Killing of Engelmann spruce remained low in both Oregon and Washington. Small outbreaks occurred on the Umatilla and Wallowa-Whitman National Forests in Oregon and on the Colville and Kaniksu National Forests in Washington. No increase in tree killing is expected in 1969.

Pine engraver, *Ips pini* (Say). Tree killing by this bark beetle increased in both Oregon and Washington. The most severe losses occurred on the Malheur and Wallowa-Whitman National Forests in Oregon. In Washington, tree killing was concentrated on the Umatilla National Forest and Glenwood District of the Washington State Department of Natural Resources. The severe drought and high temperatures during the summer of 1967 probably contributed to the population buildup. Populations are expected to remain static or decrease slightly in 1969.

Fir engraver, *Scolytus ventralis* LeC. Outbreaks of this bark beetle caused the most severe killing of true fir in Oregon and Washington in recent years. Aerial surveys revealed heavy losses on the Malheur, Rogue River, Umatilla, and Wallowa-Whitman National Forests in Oregon. Heaviest losses in Washington occurred on the Colville and Umatilla National Forests. Direct control is not planned, but salvage of infested and dead trees will be done where possible.

Silver fir beetles, *Pseudohylesinus* spp. Activities of these bark beetles were relatively minor in the Northwest in 1968. Small patches of true fir killing were most common on the Mt. Baker and Olympic National Forests in Washington. No tree killing was observed in Oregon. No major epidem-

ics are expected in 1969. Salvage of beetle-infested trees, where possible, is the only control planned.

Balsam woolly aphid, *Adelges piceae* Ratz. Tree killing in true firs was generally higher in both Oregon and Washington during 1968. Damage, particularly in subalpine fir, is now common along the crest of the Cascade Mountains from the Skykomish River in Washington southward to Crater Lake National Park in Oregon. Salvage of infested, merchantable trees and those of declining thrift is being done where possible.

Western hemlock looper, *Lambdina fiscellaria lugubrosa* (Hulst). Heavy defoliation of western hemlock in the Bacon Creek drainage on the Mt. Baker National Forest in Washington continued. Additional heavy defoliation was detected in the Cascade River drainage. Subepidemic populations were found at widely scattered points on the Mt. Baker National Forest.

A pilot test was conducted on 500 acres of lightly infested, old-growth hemlock in Sonny Boy Creek this year. Zectran was applied by a helicopter equipped with the bi-fluid aerosol spray delivery system at the rate of 13 ounces per acre. Results were not encouraging. A 5-day mortality check showed the test reduced the population by only 20.2 percent.

A needle miner, *Coleotechnites* sp. near *milleri.* These small moths continued to cause severe defoliation of lodgepole and ponderosa pine on the Deschutes and Winema National Forests in central Oregon. Egg surveys indicate that populations will decline next year. Tree growth has been reduced, but no significant tree mortality has occurred.

Spruce budworm (western form), *Choristoneura occidentalis* Free. Very light budworm feeding was detected by ground survey in Washington on Simcoe Ridge in the south central part and on Mission Ridge on the Wenatchee National Forest. Fall egg surveys on Simcoe Ridge indicate no population buildups for next year.

Larch casebearer, *Coleophora laricella* (Hbn.). Severe defoliation of western larch continued throughout northeastern Washington. Since it was first discovered near Spokane in 1960, the moth has continued to spread westward. This year over 1 million acres of defoliation was mapped by aerial survey. Very low populations are now present at several localities as far west as the Okanogan National Forest in north central Washington. Visible defoliation is expected in these areas within the next few years. Release of the parasite, *Agathis pumila* (Ratz.) continues. This year, parasites were released at five additional sites, bringing the total release sites over the past 3 years to 25.

Larch bud moth, *Zeiraphera griseana* (Hbn.). Light infestations occurred in western larch at small, widely scattered spots on the Wenatchee and Snoqualmie National Forests in Washington. Defoliation by this insect is not expected to become serious in 1969; hence, no control is planned.

Larch sawfly, *Pristiphora erichsonii* (Htg.). This insect continues to cause light to heavy defoliation of western larch at widely scattered locations in both States. In Oregon, damage was limited to the Mt. Hood National Forest and the Warm Springs Reservation. Defoliation in Washington occurred in small patches on the Colville and Kaniksu National Forests in the northeast corner of the State and on the Yakima Indian Reservation in the south central part. The parasite-predator complex associated with this insect is expected to hold damage to a low level.

European pine shoot moth, *Rhyacionia buoliana* (Schiff.). Extensive surveys in many cities, small communities, and nurseries throughout Oregon and Washington reported no new infestations in 1968 outside the known zone of infestation. Known infestations now occur in many cities of western Washington as well as the Pasco-Kennewick-Walla Walla area in southeast Washington. In Oregon, the only known infestations occur at Hermiston and McNary Dam. European pine shoot moth hazard to native ponderosa pines is being tested at the Pringle Falls Experimental Forest near Bend in central Oregon. Personnel of the Pacific Northwest Forest and Range Experiment Station are making the tests.

Douglas-fir engraver, *Scolytus unispinosus* LeC. Increased top-killing of Douglas-fir occurred throughout the Willamette Valley and southwest Oregon. The damage is not expected to become severe and will probably lessen next year.

Other insects. Sawflies were numerous but caused no serious problems. The hemlock sawfly, *Neodriprion tsugae* Midd. was abundant on the Mt. Hood National Forest in Oregon and on the Mt. Baker National Forest in Washington. Light defoliation was evident in areas of most abundance. An undetermined species of *Neodriprion* moderately defoliated true firs on 750 acres on the

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Survey entomologist uses an aluminum pole pruner with attached basket to sample western hemlock looper larvae. (Mt. Baker National Forest, Wash.)

Winema National Forest in Oregon. A tent caterpillar, *Malacosoma* sp., lightly defoliated red alder in the coastal valleys of Oregon. Disease is expected to reduce the population, and less damage is predicted next year. Moderate defoliation of red alder along the Oregon coast and southern Washington coast resulted from the feeding of the alder flea beetle, *Altica ambiens* LeC. The pine needlesheath miner, *Zelleria haimbachi* Busck, caused light defoliation of lodgepole pine in and around Olympia, Washington. Minor defoliation of ornamental spruce and Douglas-fir by the silver-spotted tiger moth, *Halisidota argentata* Pack., was common along the northern coast of Oregon.

F—518945

Site at Pringle Falls Experimental Forest, Oreg., where hazard of European pine shoot moth to native ponderosa pine is tested.

F–518946

Larvae of silver-spotted tiger moth feeding on Sitka spruce along northern Oregon coast.

CALIFORNIA

By John R. Pierce

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San Francisco, Calif.

Conditions in Brief

The year passed with less than normal damage by insects to the forests of California. The most serious problem in the State is an epidemic of western pine beetle in 7,000 acres of young-growth pine near McCloud, Calif. Other localized outbreaks of bark beetles occurred but none of these spread or intensified to the scope of a major epidemic. In most instances, these infestations were located under conditions that permitted effective salvage logging.

A dramatic increase in scale insect activity developed when fairly extensive infestations became established in three areas of the State. Although recreation, watershed, and timber values are endangered by the weakening effects these insects have on the trees, natural control forces are expected to curtail the outbreaks before any tree mortality actually occurs.

Other localized or isolated cases of insect activity include a devastating epidemic of grasshoppers in a pine plantation; a rapid enlargement of a persistent needle miner infestation of Jeffrey pine, and the rediscovery of the Douglas-fir tussock moth in California.

Status of Insects

Western pine beetle, *Dendroctonus brevicomis* LeC. The most serious forest insect problem in California in 1968 was the continuation of the western pine beetle epidemic at McCloud Flats, Siskiyou County. Midsummer evaluations there showed 2 years of serious tree killing on 7,000 acres of dense 60- to 80-year-old stands of ponderosa pine. Control of this epidemic began in October when 7,000 currently infested trees were sold in salvage sales. Supplemental spraying with lindane, to treat unmerchantable infested trees, is planned to complete the control job. Other tree killing by the western pine beetle occurred in localized areas on the Sequoia, Sierra, Stanislaus, and Eldorado National Forests.

In southern California, the western pine beetle became more destructive in 1968 following several years of only endemic activity. The most serious problems developed at Lake Arrowhead, San Bernardino County, and Julian, San Diego County. The increasing trend in beetle activity near Julian resulted from the Pine Hills Fire in 1967. The increase in other areas coincided with deficient spring precipitation throughout the southern part of the State.

Control in these locations is advisable to protect valuable recreation areas or curtail upward trends of bark beetle activity.

Fir engraver, *Scolytus ventralis* LeC. Increased tree killing by the fir engraver was noticed in 1967 and additional centers were detected in the early months of 1968. Evaluations of several infestations showed that most of the attacks occurred in 1967 with the trees fading in 1968. Although activity of this beetle probably declined in the past year, several areas in Humboldt, Siskiyou, Trinity, Lassen, and Modoc Counties will be kept under close surveillance to detect delayed fading of 1968 attacked trees.

Mountain pine beetle, *Dendroctonus ponderosae* Hopk.=(*D. monticolae* Hopk.), killed fewer trees during 1968 in California than in other re-

cent years. Activity of this beetle in ponderosa pine and lodgepole pine was at a very low level.

A more serious problem was the mountain pine beetle attacking and killing scattered mature sugar pine in numerous areas, particularly on the Sequoia, Stanislaus, Lassen, and Klamath National Forests. The infestation on the Sequoia National Forest was directly associated with numerous lightning strikes on very large trees. Control of these scattered infestations continued by logging infested trees.

Beetle activity in young-growth sugar pine stands declined during the year.

Jeffrey pine beetle, *Dendroctonus jeffreyi* Hopk. Scattered single trees and small groups of Jeffrey pine harboring the Jeffrey pine beetle were detected at Brightman Flats, Tuolumne County, and Kern Plateau around Nine Mile Creek, Tulare County. At Brightman Flats, the infestation was associated with heavy dwarf mistletoe infections; while on the Kern Plateau most of the activity centered around lightning-damaged trees.

In southern California, high endemic infestations continued at Big Bear and Snow Valley, San Bernardino County. Both areas are located in maintenance control projects.

Jeffrey pine beetle activity in the remainder of the State declined to a low level.

Douglas-fir beetle, *Dendroctonus pseudotsugae* Hopk. Following the destructive epidemic of 1966, the Douglas-fir beetle infestation declined sharply in 1967 and further subsided to an endemic level in 1968.

Engraver beetles, *Ips* spp. Only limited damage resulted from engraver beetle infestations despite the deficient moisture received during the spring of 1968. Eventually, by late summer and early fall, some successful top killing of living trees occurred in the central and southern Sierra Nevada Mountains and southern California where moisture stress was probably the most pronounced. In several locations, the western pine beetle attacked ips-weakened trees causing localized "epicenters" of complete tree kill.

Other beetles in the bark and twigs of trees. The California flatheaded borer, *Melanophila californica* Van Dyke, continued to kill Jeffrey pine in southern California; the most damage was in the Laguna Mountains of San Diego County. The flatheaded fir borer, *Melanophila drummondi* Kby., killed some small and medium size Douglas-fir trees at Bierce Ridge, Hughes Saddle, and Tannery Gulch in Trinity County.

Early frost damage and an infestation of a death-watch beetle, *Ernobius* sp. (family Anobiidae), caused severe dieback of twigs of Jeffrey pine at Lake Hemet, Riverside County. A twig beetle, *Pityophthorus* sp., was found killing twigs of bristlecone pine in the Methuselah Grove, Inyo County. Conspicuous twig beetle damage was reported on ponderosa pine at Stump Springs in Fresno County, and on white fir at Reverse Peak, Mono County.

Sapsucking insects. A severe infestation of the pine needle scale, *Phenacaspis pinifoliae* (Fitch), developed on Jeffrey and lodgepole pine in the community of South Lake Tahoe, El Dorado County. Property owners there are very apprehensive of the weakening effect of this scale on their shade and ornamental pines.

A matsucoccus scale persisted into 1968 and severely defoliated sugar pine along 5 miles of the Calaham-Cecilville Highway in Siskiyou County. Taxonomic studies have not definitely established the species of this scale. It is now designated as *Matsucoccus* sp. near *acalyptus*. An extensive infestation of *Matsucoccus acalyptus* Herb., damaged single-leaf pinyon pine on 2,200 acres at Ozena, Ventura County.

Defoliating insects. The low level of defoliating insect damage continued in California's forests in 1968. The silver-spotted tiger moth, *Halisidota argentata* Pack., was the most widespread defoliator of conifers in the State, but caused only minor damage. Detection reports on this insect were received from northwestern California, Mt. Shasta, and the central and southern Sierra Nevada Mountains. The caterpillars were much more numerous than usual in some locations, particularly on the Jackson State Forest, Mendocino County, and Pine City Mountain, Mariposa County.

Needle miner infestations in lodgepole pine and white fir, caused by *Coleotechnites milleri* (Busck), and *Epinotia meritana* Hein. respectively, continued at a low level. However, the lodgepole needle miner, which is now midway through the 2-year life cycle, has suffered considerably less than normal natural mortality. This may result in an upward trend in 1969. A persistent infestation of *coleotechnites* sp., in Jeffrey pine at Snow Valley,

San Bernardino County, increased from 25 to 105 acres in extent.

A small number of caterpillars and adult male moths of the potentially destructive Douglas-fir tussock moth, *Hemerocampa pseudotsugata* McD., were collected at Wilcox Springs near Hat Creek, Shasta County.

No control efforts to suppress conifer defoliators were undertaken in 1968.

Several reports of defoliators on hardwood trees and brush species were received in 1968. The Great Basin tent caterpillar, *Malacosoma fragile* (Stretch), was found in increasing numbers in several areas of northern California. Damage also occurred on elm from feeding of the elm leaf beetle, *Pyrrhalta luteola* (Müller); alder by the alder flea beetle, *Altica ambiens* LeC.; and oak by the California oakworm, *Phryganidia californica* Pack.

Insects damaging plantations and young trees. *Bradynotes obesa opima* Scudder, a little known short-winged grasshopper native to northern California, severely damaged recently established pine plantations on the western slope of Mt. Shasta, Siskiyou County. Surveys showed damage present on approximately 4,200 acres with nearly all of the young trees destroyed on 800 acres. A control program was conducted by the Agricultural Research Service to suppress this epidemic. Malathion, at the rate of 8 ounces per acre, was applied to the 4,200-acre infestation with good results.

F–518947

Grasshoppers severely damaged pine seedlings planted near Mt. Shasta in northern California.

Reproduction weevil damage increased slightly in 1968 above the low level of recent years. *Cylindrocopturus eatoni* Buch., was found damaging ponderosa pine plantations at Spring Hill, Siskiyou County; McCauley Hill, Mariposa County; and sugar pine at Iron Mountain, El Dorado County. *Cylindrocopturus furnissi* Buch., was active in the Kettenpom Plantation, Trinity County. Weevil damage appeared to be closely associated with severe brush competition or poor site conditions.

Pitch moths on the Lava Butte Plantation of the Sequoia National Forest show no evidence of decline. Moths identified as *Petrova edemoidana* (Dyar), *Hilarograph regalis* (Wlshm.), *Elatobia fuliginosella* (Zella), and *Bondia* sp., were previously reared from infested trees. The infestations have persisted since 1965 and although no tree mortality has resulted, the trees are suffering severe bleeding and some deformation.

INTERMOUNTAIN STATES [1]

By William H. Klein and J. A. E. Knopf [2]

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Ogden, Utah

Conditions in Brief

The mountain pine beetle continues to be the number one forest insect problem in the Region today. Heavy, but generally decreasing, infestations continue to deplete the lodgepole pine forests of eastern Idaho and western Wyoming. The once

[1] Includes forested lands in Utah, southern Idaho, western Wyoming, and Nevada. (Also includes Toiyabe National Forest, Calif.)

[2] Entomologists at Ogden, Utah, and Boise, Idaho, respectively.

destructive outbreak on the Teton National Forest and adjacent lands continues to subside. On the Targhee National Forest, most of the noncontrol areas have declined naturally; tree killing increased significantly in another area where control had been applied for several years and then stopped; and in a third area, an intensive chemical control program has reduced tree killing and is slowing the beetle's movement into previously beetle-free areas. The serious infestations on the Bridger National Forest and in Yellowstone National Park continue to increase while elsewhere in the Region, on the Sawtooth National Forest, Idaho, the Caribou National Forest, Idaho and Utah, and the Cache, Wasatch, and Ashley National Forests, Utah, infestations remained static or decreased. Mortality of ponderosa pine caused by this beetle increased slightly in the Region.

Spruce budworm populations, at a low level for the last 2 years, increased significantly in both intensity and size of infested area in 1968. The largest increases were on the Payette and Bridger National Forests. These and other infestations are expected to increase even further in 1969. No control is planned.

The Engelmann spruce beetle increased generally throughout portions of southern Idaho and western Wyoming, but most other important bark beetles and defoliators in the Region remained at the same level or decreased.

Status of Insects

Mountain pine beetle, *Dendroctonus ponderosae* Hopk.=(*D. monticolae* Hopk.). The mountain pine beetle continues to deplete the lodgepole forests of the Intermountain West, but at a rate considerably lower than that of recent years. The declining infestation in the Teton Forest and adjacent BLM lands dropped to even lower levels. In Grand Teton Park where control efforts were stopped 2 years ago, a slight resurgence is in the making on the south end, but elsewhere the infestation has remained static. To the immediate west, on the Targhee Forest, conditions vary. In most of the uncontrolled areas, such as the Rexburg and Spencer Ranger Districts, the infestations subsided on their own, but not without loss of lodgepole pine. Along the Teton Valley where control was undertaken for several years and then stopped, a resurgence occurred and heavy tree killing continues. In the control area north and northeast of Ashton, tree killing continues but at a rate far below that of the adjacent noncontrol area. Control by chemical spraying of individual trees is planned for 1969, but over a smaller area, to reduce tree killing and slow the beetle's progress in areas where intensive logging is planned. Next to the control area, to the east in Yellowstone National Park, beetle populations and tree killing have increased at an alarming rate.

Heavy beetle infestations still persist on the Bridger National Forest in western Wyoming. On the Bridger Division, tree killing has slowed somewhat in the older infestations, but beetle populations have been rejuvenated by pushing eastward into previous beetle-free stands. In the Wyoming Division, static tree killing continues along the lower Greys River, but an increasing tendency was observed in the upper Little Greys drainage. In eastern Idaho and northern Utah, on the Caribou and Cache Forests, infestation levels remained about the same as last year with no significant increases predicted. Scattered outbreaks continue to deplete lodgepole pine in localized areas on the Sawtooth Forest in southern Idaho.

F–518948

Portable stereo viewer used to pinpoint bark beetle infestations on small format aerial photos. (Ogden, Utah.)

The once serious infestations on the Wasatch and Ashley Forests are at an all time low.

Mountain pine beetle activity in ponderosa pine increased slightly Region-wide. The persistent infestation near Cascade, Idaho, killed as many trees this year as last and shows signs of spreading to the southeast onto Boise Cascade lands. Control may be necessary in 1969 to halt its spread. Tree mortality increased in two separate infestations on the Ashley Forest in Utah, one adjacent to the newly formed Flaming Gorge Recreation Area. Esthetic values are threatened by scattered tree killing in Bryce Canyon National Park, and to a lesser extent on adjacent Dixie National Forest, also in Utah.

Spruce budworm (western form), *Choristoneura occidentalis* Free. The 2-year respite from heavy and damaging spruce budworm populations may finally be coming to an end. Increases in defoliated area were recorded in practically all of the existing infestations, some significantly. The single largest increase was in Douglas-fir-true fir stands on the Payette Forest, Idaho. The next largest increase was on the Bridger Forest, Wyo., where the infestation boundaries moved out to include portions of the neighboring Teton and Targhee Forests, Wyo., and the Caribou Forest, Idaho. Increased defoliation was also recorded on the Boise, Challis, Salmon, and Sawtooth Forests in southern Idaho. A small localized outbreak was recorded for the first time on the Ashley Forest in northern Utah. All infestations are expected to increase in both intensity and size in 1969, with top kill and some understory mortality expected to occur in heavily defoliated areas in the Bridger Forest infestation. No control is planned.

Engelmann spruce beetle, *Dendroctonus obesus* (Mann.) = (*D. engelmanni* Hopk.). This insidious beetle has exhibited a slow but steady Region-wide increase for the last 2 years. Most of its activity is restricted to high elevation spruce in inaccessible locations on the Teton, Targhee, and Bridger Forests, and Grand Teton Park, Wyo. A potentially serious outbreak in standing spruce was averted by a combination of logging, chemical treatment, and trap trees near Hazard Lake on the Payette Forest, Idaho. The destructive infestation in an inoperable spruce stand on Hilgard Mountain on the Fishlake National Forest, Utah, continues unabated. Spruce logs left in the woods because of inclement weather pose a hazard to nearby standing trees in sale areas on the Uinta and Dixie Forests, Utah. All logs will be removed by summer of 1969, however.

Douglas-fir beetle, *Dendroctonus pseudotsugae* Hopk. With the exception of southern Idaho, populations of this beetle are at a very low level. Since the initial buildup from windthrown Douglas-fir 3 years ago, beetle populations have sustained themselves in standing trees throughout portions of the Boise, Payette, Sawtooth, and Salmon Forests. Logging for both salvage and control is impractical because of the scattered nature of the infestation. Unless natural control factors intervene, a high level of tree killing throughout southern Idaho will probably continue.

Engraver beetles, *Ips* spp., continued to kill second-growth ponderosa pine but at a reduced rate, in localized outbreaks on the Payette and Boise Forests, Idaho. Broods emerging from spring logging slash killed several hundred Jeffrey pine in Dog Valley on the Toiyabe National Forest, Calif. Curtailment of spring and early summer logging and thinning activities will preclude new outbreaks.

Roundheaded pine beetle, *Dendroctonus adjunctus* Blandf. For the second straight year, aerial surveys showed a widely scattered outbreak of this beetle in both mature and overmature ponderosa pine in the Charleston Mountain area, Toiyabe Forest, 20 miles west of Las Vegas, Nev. Brood trees were felled and burned where possible, but the presence of dead and dying trees, even though scattered and few in number, has caused concern from local summer homeowners. At this time, the trend of the infestation is unknown.

Sugar pine tortrix, *Choristoneura lambertianae* (Busck.) continues to cause noticeable but apparently not serious damage to lodgepole pine stands in eastern Idaho and western Wyoming. The perennial infestation west of Bishop Mountain on the Targhee Forest finally subsided, but defoliation increased along Teton Valley, in Teton Park, and in young lodgepole stands on the Teton Forest. Preliminary observations in localized areas indicate that the early instars of this insect, along with *Dioryctria* sp., may be mining the new buds of lodgepole reproduction, thereby stunting the growth.

A tussock moth, *Hemerocampa* sp. has been epidemic on *Ceanothus* sp. in the Town Creek Plantation of the Boise Forest for several years.

Wherever the host plant was depleted, larvae migrated to nearby ponderosa pine plantings and caused light to moderate defoliation. Normally, the female tussock moths lay their eggs on ceanothus, but this year new egg masses were found for the first time on the young ponderosa pine. It is not known whether this abnormal activity portends increased defoliation of ponderosa pine, but if it does and natural control factors such as a native polyhedrosis virus are not effective, then emergency control may be needed.

A tent caterpillar, *Malacosoma* sp. Persistent populations of this insect continue to defoliate Fremont cottonwood along the Virgin and Sevier Rivers in southern Utah, but considerably under the high level of recent years. For the fourth consecutive year, mistblower application of *Bacillus thuringiensis* (Berliner), provided nuisance protection from migrating caterpillars in high-use areas in Zion National Park, Utah.

Other insects. The western pine beetle, *Dendroctonus brevicomis* LeC., caused widely scattered tree killing throughout southern Idaho and in three recreation areas on the Dixie Forest in southern Utah. Populations are expected to remain static. Fir engraver, *Scolytus ventralis* LeC., and western balsam bark beetle, *Dryocoetes confusus* Sw., remained endemic for the second consecutive year.

The white fir needle miner, *Epinotia meritana* Hein., continued to decline in Bryce Canyon Park and Dixie Forest, Utah. In the same area, however, another defoliator, *Argyrotaenia dorsalana* (Dyar), caused early but not serious damage to white fir. A weevil, *Pissodes*, sp., continues to kill terminal leaders of lodgepole pine reproduction near Alturas Lake, Sawtooth Forest, Idaho. A seedworm, *Laspeyresia* sp. (possibly *piperana*), and other cone inhabiting insects, caused extensive damage to ponderosa pine cones in the Crooked River cone collection area near Council, Idaho. A looper, yet to be identified, completely defoliated gambel oak and other growth along portions of the Wasatch Front near Provo, Utah. A mealy bug, *Puto sandini* Washburn, continues its slow attrition of Engelmann spruce on portions of the Dixie and Fishlake Forests in Utah. *Anacamptodes clivinaria* (Guenée), a defoliator of mountain mahogany in Owyhee County, Idaho, remained at a low level for the second straight year. Chokecherry and big-tooth maple were defoliated by the forest tent caterpiller, *Malacosoma disstria* Hbn., in one area on the Cache Forest, Utah. The blackheaded budworm, *Acleris variana* (Fern.), along with the spruce budworm, continued to defoliate Douglas-fir and true fir in an isolated outbreak on the Caribou Forest, near Montpelier, Idaho. Natural factors reduced populations of a sawfly,

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This tip weevil damaged the terminal leaders of lodgepole pine reproduction in Sawtooth Valley, Idaho.

F—518950

One of many loopers (unidentified) responsible for complete defoliation of gambel oak near Provo, Utah.

Neodiprion edulicolus Ross, a defoliator of pinyon pine in southeast Nevada, to a very low level. A widespread outbreak of the Great Basin tent caterpillar, *Malacosoma fragile* (Stretch), caused extensive defoliation of bitterbrush and other range plants throughout the Intermountain area. The pinyon needle scale, *Matsucoccus acalyptus* Herb., continued to defoliate pinyon pine in localized outbreaks in southern Utah.

NORTHERN ROCKY MOUNTAINS [1]

By FREDERICK W. HONING

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Conditions in Brief

The spruce budworm epidemic increased in severity and expanded in Douglas-fir and true fir forests of Idaho and western Montana. The 1968 infestation covered a total of 4.2 million acres, half of which is in Idaho. A severe outbreak of spruce beetle developed in slash and windthrown Engelmann spruce trees in the Flathead National Forest, Mont. Logging-for-control is planned.

Damage by the mountain pine beetle continued to increase in mature lodgepole, ponderosa, and white pine stands of the Region. Approximately 1,300 infested ponderosa pine trees on Monarch Mountain, Lewis and Clark National Forest, Mont., were treated with a toxic chemical. Ponderosa pine tree killing by engraver beetles decreased throughout western Montana.

Larch casebearer continued to spread and was reported for the first time in Glacier National Park, Mont. Some 45,000 square miles of larch were infested in 1968. Casebearer parasites have been recovered from 60 percent of 1964–66 release sites.

Infestations of sugar pine tortrix decreased, but defoliation caused by the pine needle-sheath miner increased. Spruce budworm and the fir cone worm continued to destroy a high percentage of Douglas-fir seed in some areas of Montana. Populations of larch sawfly and larch bud moth were reduced to endemic levels by natural factors.

[1] Includes forested lands in Montana, northeastern Washington, northern Idaho, North Dakota, northwestern South Dakota, and National Park Service land in northern Wyoming.

No major projects were undertaken to control large-scale chemical control projects planned for 1969.

Status of Insects

Spruce budworm (western form), *Choristoneura occidentalis* Free. A widespread increase in scope and severity of infestations occurred in northern Idaho and western Montana in 1968. The 1968 infestation covered a total of 4.2 million acres of Douglas-fir and true fir timber. Ten percent of the area had heavy defoliation. Defoliation occurred in some areas of north Idaho for the first time in 15 years. Most extensive damage occurred on the Nezperce and Clearwater National Forests, Idaho. Budworm activity continued to decrease east of the Continental Divide in Montana. The increasing trend is expected to continue in Idaho and western Montana through 1969.

Two heavily defoliated areas of mixed fir, spruce, larch, lodgepole, and ponderosa pine were sprayed with 1 ounce (6 percent by volume) of Zectran in 1 pint of Dowanol (carrier) per acre in the Blackfoot River drainage, Montana. Population reduction was 70.0±4.2 percent in Belmont Creek and 47.8±5.5 percent in Chamberlain Creek.

An aerial application of Zectran on about 12,000 acres is planned for 1969.

Engelmann spruce beetle, *Dendroctonus obesus* (Mann.) = (*D. engelmanni* Hopk.). A major outbreak of spruce beetles developed in northwestern Montana in 1968, the most serious on parts of the Kootenai and Flathead National Forests, and adjacent State and private lands in Montana. It is believed the infestation started in trees uprooted by strong winds in 1966. Logging slash left unburned because of hot, dry weather conditions may have also contributed to beetle population buildup. Preliminary survey data indicates an average of 4.3 trees per acre are infested in drainages along North Fork Flathead River, Glacier View Ranger District, Flathead National Forest. Logging-for-control of about 100 MMBF of infested spruce is planned for the next 2 years. Smaller outbreaks occurred on parts of the Clearwater and Kaniksu National Forests, Idaho.

Mountain pine beetle, *Dendroctonus ponderosae* Hopk. = (*D. monticolae* Hopk.). The mountain pine beetle has caused serious losses in overmature western white pine, ponderosa pine, and

lodgepole pine stands of the Northern Rocky Mountain Region since 1963. Chronic white pine tree killing occurred in the headwaters of Upper Priest River, Priest Lake District, Kaniksu National Forest, Idaho. Infestations are still active near St. Regis, and along the foothills of the Big and Little Snowy Mountains, Mont. Infestations remained static in lodgepole pine on the Yaak District, Kootenai National Forest, Mont. Beetle populations are endemic in ponderosa pine on the Lincoln District, Helena National Forest, Mont.

Approximately 1,300 infested ponderosa pine trees on Monarch Mountain, Belt Creek District, Lewis and Clark National Forest, Mont., were sprayed with ethylene dibromide in June. About 300 trees will need to be treated in 1969 to suppress this outbreak.

Flatheaded fir borer, *Melanophila drummondi* (Kirby), killed many Douglas-fir and larch trees weakened by mistletoe and drought—north from Missoula to Kalispell, Mont. Losses are expected to decrease in 1969.

Pine engraver, *Ips pini* (Say.). Tree killing by engraver beetles decreased in Montana and Idaho in 1968. The decrease in beetle activity may be attributed to wet weather during beetle flight this spring. Several small groups of 2 to 25 trees were recently killed in the Flathead Valley near Polson, Mont., and along the Clark Fork River near Frenchtown, Mont. Losses from pine engraver are expected to continue to decrease in 1969.

Larch casebearer, *Coleophora laricella* (Hbn.). Epidemic casebearer populations continued to spread through larch stands of western Montana, northern Idaho, and eastern Washington. This defoliator was recorded for the first time near Lake McDonald, Glacier National Park, Mont. The limits of infested larch extended northeast in Montana, but remained static throughout the rest of the infested area. About 45,000 square miles of timbered stands mixed with western larch are infested. Tree mortality and branch dieback occurred in Hudlow Creek northeast of Coeur d'Alene, Idaho. The trend of damage is upward.

A casebearer parasite, *Agathis pumila* (Ratz.). More than 500,000 parasites were released in western Montana during 1968. Parasites have been recovered from 60 percent of releases made in 1964 and 1966. Distribution will continue in 1969. No releases were made in Idaho this year.

Lodgepole pine terminal feeders. A complex of lodgepole pine terminal feeders which include the sugar pine tortrix, *Choristoneura lambertianae* (Busck); the pine needle-sheath miner, *Zelleria haimbachi* Busck; and unidentified sawfly; and a geometrid, caused light to moderate defoliation in about 170,000 acres of lodgepole pine stands in Montana, Idaho, and Yellowstone Park, Wyo. The needle-sheath miner alone caused more than half of the defoliation. A slight decrease occurred in sugar pine tortrix populations. Damage trend is expected to be static to downward.

Seed and cone insects. Analysis of data from permanent plots in Montana indicate Douglas-fir seed destruction by spruce budworm (western form), *Choristoneura occidentalis* Free., remained moderate to heavy. The fir coneworm, *Dioryctria abietella* (D.&S.), caused as much heavy damage as budworm. Douglas-fir scale midge, *Contarinia washingtonensis* Johnson, and the Douglas-fir seed chalcid, *Megastigmus spermotrophus* Wachtl., accounted for moderate seed losses.

Douglas-fir beetle, *Dendroctonus pseudotsugae* Hopk. Tree killing by this bark beetle was observed in the East Fork Bitterroot River drainage, Mont., and along the north-facing slopes of the Salmon River near Riggins, Idaho. Salvage logging-for-control will help reduce future tree killing.

Fir engraver, *Scolytus ventralis* LeC. Damage caused by fir engravers increased the past few years in grand fir growing on the Coeur d'Alene and Clearwater National Forests, Idaho. Logging-for-control is recommended in accessible areas.

A pine tussock moth, *Dasychira* sp. near or equal *grisefacta* Dyar. Hibernating larvae of this tussock moth were found under the bark of ponderosa pine in very scattered areas from Liscom Butte south to Poker Jim Lookout on the Custer National Forest, Mont. Light defoliation of pine reproduction was evident near Liscom Butte. No defoliation was visible from the air.

Other insects. A pine shoot moth, *Eucosma* sp. Populations of this insect caused heavy tip killing of new growth in a ponderosa pine plantation near Joe Springs on the Nezperce National Forest, Idaho. The larch bud moth, *Zeiraphera griseana* (Hbn.), and larch sawfly, *Pristiphora erichsonii* (Htg.), were generally endemic in north Idaho and Montana with only light, scattered feeding in

most areas. Populations of western pine beetle, *Dendroctonus brevicomis* LeC., remain at low levels in ponderosa pine top-killed by engraver beetles along the Clark Fork drainage. Top killing of spruce reproduction in north Idaho and Montana by the Engelmann spruce weevil, *Pissodes engelmanni* Hopk., remained high in 1968. Tip killing is expected to continue in 1969. A flea beetle on alder, *Altica* sp., caused skeletonization of from 75 to 100 percent of the foliage of alder—north into British Columbia and south to Sandpoint, Idaho. Pine butterfly, *Neophasia menapia* (Feld. & Feld.), is endemic in the Bitterroot National Forest, Mont.

F–518951

Sugar pine tortrix larvae feeding on lodgepole pine. (Flathead N. F., Mont.)

F–518952

Douglas-fir cone dissected to show fir coneworm and damage. (Lolo N. F., Mont.).

CENTRAL ROCKY MOUNTAINS [1]

By Donn B. Cahill and Wilmer F. Bailey

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Conditions in Brief

The Black Hills beetle remained the most important forest insect in the Central Rocky Mountains. Infestations in ponderosa pine increased on the Black Hills, Roosevelt, and San Juan National Forests. Infestations in lodgepole pine have been found on the White River, Arapaho, and Shoshone National Forests and on BLM and State and private lands in northwestern Colorado.

Efforts to control the Black Hills beetle have been continued through the use of accelerated timber sales; salvage; piling and burning; and, as a last resort, chemical application.

Engelmann spruce beetle populations remained at a low level. This insect is a threat to thousands of acres of overmature Engelmann spruce stands in Colorado and Wyoming. Some small infestations have developed in logging debris and scattered blowdown. These have been kept in check by trap tree logging or piling and burning of slash and cull material.

Spruce budworm-defoliated areas increased in acreage but remained about the same in damage intensity. The egg mass survey showed light to heavy defoliation with no extensive tree injury. Suppression projects are not recommended at this time.

Status of Insects

Black Hills beetle, *Dendroctonus ponderosae* Hopk., has been a serious problem in ponderosa pine on the Black Hills, Roosevelt, and San Juan National Forests. Infestations are located on more than a quarter-million acres. Logging, salvage of insect-infested trees, and chemical control (where logging is not feasible or timber sales do not occur) were continued in an effort to improve this situation.

In the Black Hills, beetle infestations developed from small scattered groups and from some large concentrations. An estimated 21,000 infested trees were found on State and private lands. An estimated 35,000 infested trees were found on National Forest lands. Direct control was recommended where timber harvest has not kept pace with increasing infestations.

Small scattered infestations on the Roosevelt National Forest have concentrated in groups of 25 to 100 trees. Most of these groups are in extremely rough terrain. These infestations should be controlled in areas where merchantable stands are threatened.

Beetle activity on the Glade District of the San Juan National Forest has been centered around old seed trees and second-growth ponderosa pine. This infestation will be controlled by a revised sale program and a limited treating program.

Black Hills beetle activity in lodgepole and limber pine remained about the same as in 1967. Tree mortality continued on State, private, and BLM lands in northwestern Colorado. No control work

[1] Includes forested lands in Colorado, Kansas, Nebraska, South Dakota, and Wyoming.

F–518953

Construction of the Dillon, Colo., townsite disturbed the forest microclimate, reduced tree vigor, and triggered a Black Hills beetle infestation. Note faded trees in lower center of photo.

was accomplished in this isolated area. The outbreak in lodgepole pine near Dillon, Colo. was reduced by chemical treating. Continued control was recommended to clean up small infestations on the White River National Forest.

Engelmann spruce beetle, *Dendroctonus obesus* (Mann.) = (*D. engelmanni* Hopk.), damage was not significant in standing spruce timber. A small infestation was found in a new timber sale on Greenhorn Mountain in the San Isabel National Forest. This sale will be cut next year and this should control the infestation. The beetles have been kept under control by salvage logging in the blowdown area and by trap trees and slash disposal in the sale area.

Spruce budworm (western form), *Choristoneura occidentalis* Free. Areas of budworm defoliation have increased by approximately 75,000 acres in 1968, making a total of over 175,000 acres. The heaviest defoliation was on the San Isabel, San Juan, and Rio Grande National Forests. Other infestations were scattered throughout Colorado.

Douglas-fir beetle, *Dendroctonus pseudotsugae* Hopk. Scattered mortality of Douglas-firs was observed on most forests in Colorado and on the Shoshone National Forest in Wyoming. No control is planned.

Western balsam bark beetle, *Dryocoetes confusus* Sw. Scattered groups of alpine fir throughout Colorado and Wyoming were killed by this insect.

Tiger moth, *Halisidota ingens* Hy. Edw. This insect was reported in ponderosa pine on the Poudre District of the Roosevelt National Forest and on private lands near the Pike and Arapaho National Forests. Chemical spraying by some property owners has controlled it around their homesites.

Spear-marked black moth, *Eulype hastata gothicata* (Guen.). Heavy defoliation of birch was observed on the northern Black Hills National Forest. Some property owners were concerned with defoliation of birch on their homesites.

Other insects. The fall webworm, *Hyphantria cunea* (Drury), moderately defoliated broadleaved trees and brush along Boulder Creek of the Roosevelt National Forest. The roundheaded pine beetle, *Dendroctonus adjunctus* Blandf., and the southwestern pine beetle, *Dendroctonus brevicomis* LeC. = (*D. barberi* Hopk.), were found in association with Black Hills beetle on the San Juan and Grand Mesa-Uncompahgre National Forests. The pine engraver, *Ips pini* (Say), is now considered endemic in ponderosa and jack pine on the Bessey District plantation near Halsey, Nebr.

SOUTHWESTERN STATES [1]

By H. W. Flake and C. J. Germain [2]

Division of Timber Management
Albuquerque, N. Mex.

Conditions in Brief

Increasing Engelmann spruce beetle activity continues to concern land managers in the Southwest. Vigorous and aggressive beetle populations at four epidemic infestations threaten vast acreages of mature spruce. Cultural and chemical control practices are being used in an attempt to check this pest.

Spruce budworm infestations are at their lowest level in 10 years. Population trend of this pest continues toward the endemic state.

In New Mexico, two Douglas-fir tussock moth epicenters were suppressed by city and State personnel. In Arizona, tussock moth infestations were active at Pinal and Aztec Peaks. The high incidence of natural virus at Aztec Peak is expected to cause a collapse of the population in 1969.

In a pilot control study, dimethoate was not effective in reducing damage caused by the southwestern pine tip moth. Minor infestations of several defoliators and bark beetles were active in the Southwest, but damage was light from these pests.

Status of Insects

Engelmann spruce beetle, *Dendroctonus obesus* (Mann.) = (*D. engelmanni* Hopk.). This beetle is the most serious and aggressive forest insect pest in the Southwest. High larval populations in down host material provide the impetus for standing tree infestations. With the majority of the spruce stands classed as mature and over-

[1] Includes all forested lands in Arizona and New Mexico and National Park Service land in southern Colorado and western Texas.

[2] Seed and cone insect information provided by Dr. H. Grant Kinzer, New Mexico State University, Las Cruces.

mature, the trend of Engelmann spruce beetle populations is toward epidemic conditions throughout the Southwest.

On the Santa Fe National Forest, near Espanola, N. Mex., a highly aggressive Englemann spruce beetle population that had developed in scattered windthrown spruce emerged this year and ravenously attacked standing green spruce. Ground surveys showed the infestation to be epidemic on 462 acres, with 7,676 trees attacked, or approximately seventeen infested trees per acre. This epidemic is an immediate threat to 80 MM board feet of merchantable spruce. Clearcutting the infested area, with subsequent felling of trap trees, is planned for 1968–69 to curb the infestation.

A new infestation on approximately 2,000 acreas in the San Pedro Mountains threatens vast stands of spruce in the San Pedro Wilderness and adjacent forest lands on the Cuba Ranger District, Santa Fe National Forest. Preliminary surveys indicate two successfully attacked trees per acre. Examination of infested trees revealed a high and vigorous larval population.

A persistent residual population from a previous outbreak on the Carson National Forest continues to attack standing spruce near Penasco, N. Mex. The spruce beetle population at Mt. Taylor, on the Cibola National Forest, N. Mex., is at a low level and is no longer considered a problem. Most of the mature spruce trees were killed in the 4 years this infestation was active.

In Arizona, spruce beetle is currently active throughout approximately 450 acres of standing Engelmann spruce at Escudilla Mountain on the Apache National Forest. Small pockets of infested spruce trees are appearing along the boundary common to the Mt. Baldy Primitive Area, Apache National Forest, and the Fort Apache Indian Reservation.

At the Arizona Snow Bowl, north of Flagstaff, chemical control was successful in reducing an extremely high spruce beeetle population in 800 blown down trees.

The rapid buildup of spruce beetle at all known active centers indicates further deterioration of the Engelmann spruce type.

Spruce budworm (western form), *Choristoneura occidentalis* Free. The spruce budworm continued to decline in both area and intensity in the mixed conifer stands of New Mexico. At present, the population and area infested are at the lowest level in 10 years. Only 83,000 acres are infested; a decrease of 217,000 from 1967. On the Eastern Division of the Carson National Forest, 80,000 acres are lightly infested. The Philmont Scout Ranch, owned and operated by the Boy Scouts of America, has the only infestation of any consequence: 3,000 acres are moderately infested.

With the continued decline of the budworm population, and trend toward an endemic condition, no control is planned against this pest.

Prescott scale, *Matsucoccus vexillorum* Morrison. Sapling ponderosa pines were extensively flagged in the fall of 1967 on the 800-acre Barney Pasture Plantation at Flagstaff, Ariz. Although the damage was striking, no tree mortality occurred in 1968, and damage was of little economic importance. Historically, in the Southwest, this insect caused great concern among the early land managers. However, little permanent damage resulted.

Arizona five-spined ips, *Ips lecontei* Sw., continues to cause heavy mortality of saplings and poles in logging areas on the Prescott National Forest. Volume loss is light, but stocking of the featured age class is reduced below acceptable levels. Modification of present logging and slash disposal methods has been recommended to initiate cultural control and reduce losses to a tolerable level.

Southwestern pine tip moth, *Rhyacionia neomexicana* (Dyar), continues to damage ponderosa pine seedlings in the Southwest. On the Sitgreaves National Forest, near Winslow, Ariz., 101,000 acres are infested, with the area classed as 13,000 acres heavy, 14,000 acres moderate, and 74,000 acres light. Both natural and planted stock are infested, with the planted stock sustaining the greatest damage.

In a pilot control study conducted in June, spray was applied to 1,200 acres of infested seedlings by helicopter. Dosage rates used were 0.25 and 1.20 percent dimethoate in both 1 and 5 gallons of water per acre. Results of the study have not been thoroughly analyzed, but indications are that none of the treatments significantly reduced the number of terminals infested by the tip moth.

Fall webworm, *Hyphantria cunea* (Drury), continued to cause heavy defoliation of cottonwood and willow at Bandelier National Monument, near Los Alamos, N. Mex. The National

Park Service sprayed 200 acres with Thuricide 90 TS to protect the high recreational values of this area. Results of the spraying indicate that aerial application of *Bacillus thuringiensis* (Berliner) did not reduce the larval population significantly.

The sawfly, *Neodiprion gillettei* (Roh.), continues to infest ponderosa pine seedlings on the Sitgreaves National Forest, south of Winslow, Ariz. Dimethoate showed promise as an effective chemical control agent for this sawfly.

Douglas-fir tussock moth, *Hemerocampa pseudotsugata* McD. The tussock moth infestations on ornamentals in Ruidoso and Weed, N. Mex., were suppressed by city and State personnel. Infested trees were individually sprayed with DDT. The threat to Federal lands surrounding these infestation centers has been alleviated by this action.

The two infestations on the Tonto National Forest in Arizona remained active in 1968. On Pinal

F—518954

Hungry sawfly larvae devastate a ponderosa pine seedling. (Sitgreaves N. F., Ariz.)

Peak, the population level increased over 1967, but defoliation remained below 10 percent on an estimated 200 acres. At Aztec Peak, 340 acres were infested. Total defoliation occurred on two areas of 30 and 40 acres each, within the infestation. The fall egg mass survey, however, indicates a collapse of the infestation in 1969 due to the high incidence of natural virus. The infestation was being jointly studied by Regional and Pacific Northwest Forest and Range Experiment Station (PNW) personnel as a possible test area for the natural virus formulation and related application equipment being developed by PNW. A test scheduled for 1969 has been canceled because of the high incidence of natural virus.

Giant bark aphid, *Longistigma caryae* (Harris), was collected from native sycamore on the Sedona Ranger District, and identified by the Arizona Commission of Agriculture and Horticulture. This is a new record for the State of Arizona. While not an economic pest on sycamore, this aphid is considered a serious threat to Arizona's commercial pecan industry. Surveys are being conducted to determine the extent of forest lands infested by this pest.

Pinyon needle scale, *Matsucoccus acalyptus* Herb., reached epidemic proportions on the South Rim of Grand Canyon National Park. The National Park Service treated 2,336 trees with a 0.5 percent Cygon formulation to protect the esthetics at viewpoints and lodge areas.

Roundheaded pine beetle, *Dendroctonus adjunctus* (Blandf.), continued to kill small groups of young pine on the Lincoln National Forest, east of Cloudcroft, N. Mex. An estimated 2,000 trees are currently infested. Regionally, the roundheaded pine beetle has shown renewed activity. Small localized infestations are active in the pine type on the Navajo Indian Reservation; Philmont Scout Ranch; and Apache, Prescott, and Coronado National Forests.

Seed and cone insects. The survey phase of a continuing study of seed and cone insects has been completed. Ponderosa pine was found to be attacked by 15 species of insects damaging to seeds or cones. An additional 24 cone-associated species caused no damage. Nine species of predacious insects were found in association with ponderosa cones. A 3-year survey of insect damage in two National Forests showed that *Conophthorous ponderosae* Hopk. was the most damaging insect attacking ponderosa cones, causing an annual loss of 27.8 percent. Douglas-fir was infested with 19 damaging and 12 nondamaging species. Twenty-one parasitic and two predacious insects were reared from or found in association with Douglas-fir cones. *Barbara colfaxiana* (Kearf.) and *Dioryctria abietella* (D.&S.) were the most damaging species. The biology and host-finding mechanisms of *Conophthorus ponderosae* will be investigated in future studies.

Other insects. Infestation by the fir engraver, *Scolytus ventralis* LeC., increased in northern New Mexico, but damage remained light. The infestation of alder flea beetle, *Altica ambiens* LeC., in the Whitewater Canyon Recreation Area, near Glenwood, N. Mex., has collapsed. Douglas-fir beetle, *Dendroctonus pseudotsugae* Hopk., populations on the Navajo Indian Reservation remained light, with scattered attacks occurring in the Chuska Mountains. The pine engraver, *Ips pini* (Say), caused scattered mortality throughout the Region, but damage was less than in previous years. The Great Basin tent caterpillar, *Malacosoma fragile* (Stretch), remained endemic throughout the Southwest. A flannel moth, *Megalopyge* sp., that had caused moderate defoliation to madrone, oak, and maple at Carlsbad Caverns National Park in 1967 could not be found this year. White fir that was heavily infested by the needle miner, *Epinotia meritana* Hein., in 1965 and 1966 continued to deteriorate. The full extent of mortality caused by this pest is only evident this year. Top kill of mature yellow pine by the shoot moth, *Dioryctria* sp., continues on the western end of the Sitgreaves National Forest, Arizona. The Nevada buck moth, *Hemileuca nevadensis* Stretch, defoliated native cottonwood at White Sands National Monument, New Mexico; maintenance control using Thuricide 90 T was necessary to suppress this population.

An epidemic population of pine twig beetle, *Pityogenes carinulatus* (LeC.), infesting ponderose pine seedlings in 1967 near Grants, N. Mex., subsided this year. Control measures against the grass plant bug, *Labops hesperius* Uhler, that is infesting crested wheatgrass on the Santa Fe National Forest, are planned by the Agriculture Research Service in 1969.

SOUTHERN AND SOUTHEASTERN STATES [1]

By G. L. Downing, W. M. Ciesla, and J. L. Rauschenberger [2]

Division of Forest Pest Control
Atlanta, Ga.

Conditions in Brief

The southern pine beetle remained the most serious forest insect problem throughout the South and Southeast with pine losses in east Texas at the highest levels since 1962. Populations of this pest also continued high in Louisiana, and new outbreaks developed in the coastal plains of North Carolina and in a remote section of the Great Smoky Mountains National Park.

To combat this pest, intensive logging of infested trees is being carried out in many areas. When necessary, this is combined with the chemical treatment of inaccessible and unmerchantable trees.

Declining populations of the southern pine beetle were recorded in Mississippi, Alabama, South Carolina, and Virginia. Fluctuating damage levels were reported from Georgia.

Damage by the black turpentine beetle was less in most areas and chemical control programs against this pest were terminated.

Engraver beetles killed large numbers of trees in stands severely defoliated by hail in Arkansas. Elsewhere, drought contributed to engraver beetle buildups in several areas.

The balsam woolly aphid continued its spread through the Fraser fir stands of the southern Appalachians with two new infestations detected.

The Nantucket pine tip moth caused moderate to heavy damage in many seed orchards. In Texas, this tip moth was found infesting 90 percent of the tips of shortleaf pine on 2,000 acres.

Sawflies were reported at damaging levels in several areas with the largest outbreak covering 90,000 acres of sand pine in Florida.

Fall webworm defoliation of hardwoods was once again evident in many localities, causing concern in several recreation areas.

Several other forest insects were also reported.

Status of Insects

Southern pine beetle, *Dendroctonus frontalis* Zimm., activity increased significantly over a 16-county area in southeast Texas, where this insect has been in epidemic status since 1957. The area of infestation spread northward into Shelby County and now encompasses a gross area of 5 million acres. Over 6,000 separate infestations were treated by personnel of the Texas Forest Service and private industry in this area. Emphasis was placed on rapid removal and utilization of infested material rather than chemical control. Epidemic levels of southern pine beetle requiring direct control measures occurred on four Districts of the National Forests in Texas. June evaluation surveys revealed an unusually high level of 184 trees per 1,000 acres host type on the Angelina District. The level of infestation increased to 311 trees per 1,000 acres by October. The southern pine beetle was detected for the first time on the Tenaha District.

A serious outbreak has developed in a 12-county area in the coastal plains of North Carolina. One spot in Lenoir County exceeds 100 acres in size. This epidemic represents a major shift in beetle activity from the central and northern piedmont area to the southeastern portion of the state. The North Carolina Division of Forestry, in cooperation with private landowners, salvaged 5,000 cords and 2,150,000 board feet of beetle infested pine during fiscal year 1968. In western North Carolina on the Tusquitee District of the Nantahala National Forest and adjoining State lands, the beetle continues to cause moderate damage. During fiscal year 1968, the district cut, piled, and burned over 1,200 infested trees in the mountainous terrain of the area.

Losses caused by the southern pine beetle continued over several geographically separated areas in Louisiana. Localized infestations near Sulphur reached a level of 49 trees per 1,000 acres of host type during June. Infestations in Allen Parish continued at a moderate level with concentrations of activity occurring in the East Bay Area. An

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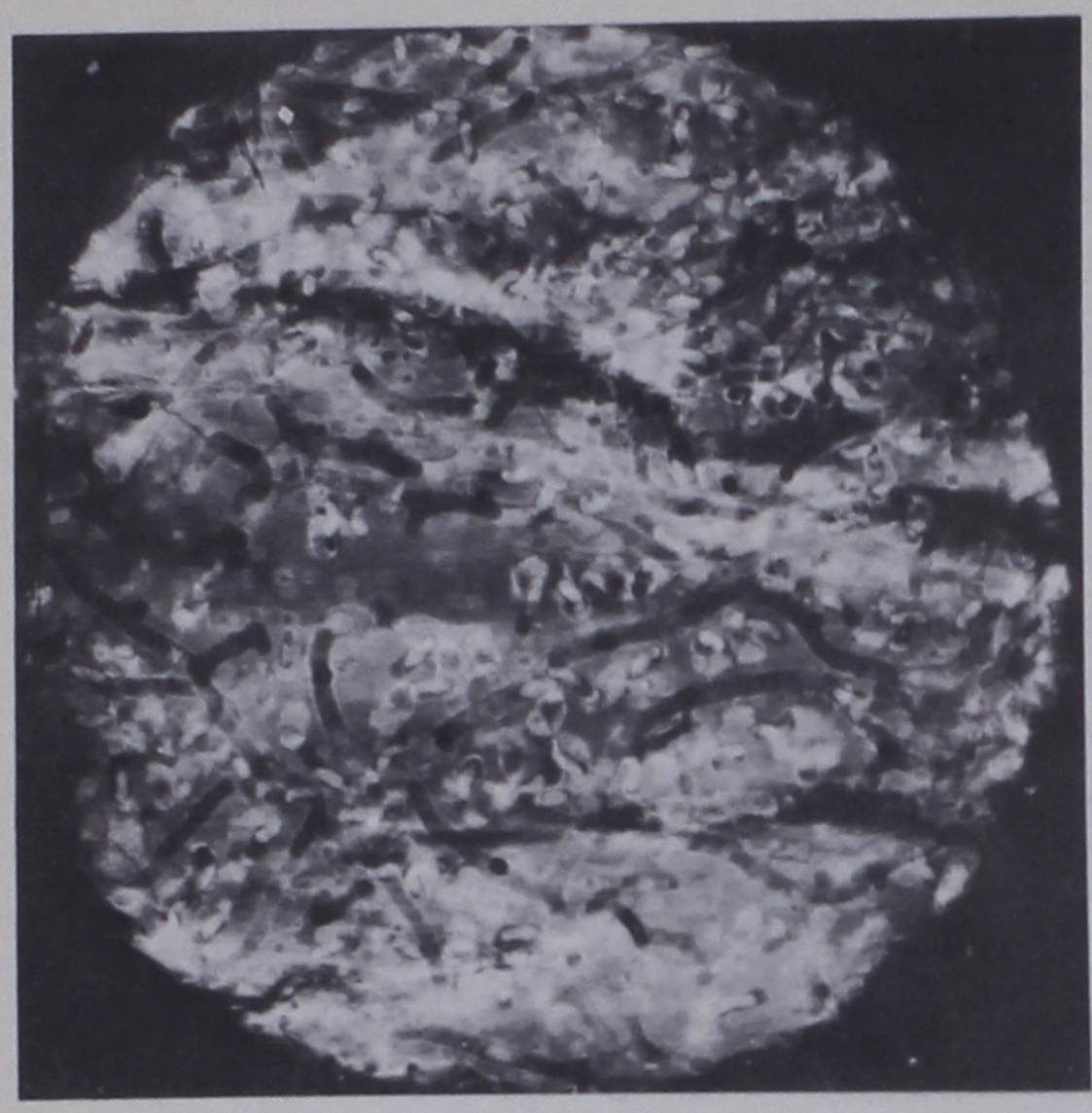
[1] Includes forested lands in Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, and Virginia.

[2] Entomologists at Atlanta, Ga., Alexandria, La., and Asheville, N.C., respectively.



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X-ray reveals heavy southern pine beetle brood density within pine bark. (Atlanta, Ga.)

outbreak area (detected in 1967), which encompasses nearly a half million acres in east-central Louisiana, continued at somewhat lower levels during 1968. Populations east of Baton Rouge, in southeast Louisiana, declined to epidemic levels no longer requiring chemical control. Localized southern pine beetle activity continued in the Calcasieu River bottom in Rapides Parish.

Southern pine beetle activity declined to endemic levels on the Homochitto National Forest and adjoining private lands in southwestern Mississippi. The June level of infestation was 0.38 trees per 1,000 acres host type. Brood densities declined to 50 insects per square foot of bark surface. Consequently, chemical control operations were terminated in this area.

Epidemics in central Alabama declined to low levels. Chemical control projects were terminated on the four Districts of the Talladega National Forest. Infestation levels remained at two trees per 1,000 acres host type on the William B. Bankhead National Forest, in northwestern Alabama, with brood densities averaging 240 insects per square foot of bark surface.

Populations of southern pine beetle have decreased sharply on the Tyger and Long Cane Districts of the Sumter National Forest in central South Carolina. Evaluations made in October revealed high numbers of beetle-killed trees but very few active brood trees. The decline has been attributed to above average temperatures in August, when they exceeded 100° F. for 3 straight days. On the Andrew Pickens District in northwestern South Carolina, temperatures did not reach such levels and beetle populations did not decline. Beetle activity on the Francis Marion National Forest in southeastern South Carolina continues to cause moderate damage with an estimated 6.16 ± 3.38 infested trees per 1,000 acres of host type.

Southern pine beetle infestations detected in a remote, roadless section of the Great Smoky Mountains National Park in Tennessee during January 1968 continue to cause heavy damage to scattered pine types. The level of infestation in the fall of 1968 was estimated at 495.4 ± 226.9 infested trees per M acres of host type.

Southern pine beetle infestation levels have increased slightly during 1968 and caused moderate losses on the Chattooga and Tallulah Districts of the Chattahoochee National Forest in Georgia. Low intensity infestations were detected on the Brasstown District of the Chattahoochee for the first time in several years. Beetle activity on the Uncle Remus District of the Oconee National Forest and the Hitchiti Experimental Forest has changed little since 1967. The infestation level in 1968 was 4.5 infested trees per 1,000 acres of host type. The Georgia Forestry Commission reports a decline in southern pine beetle activity in northeast Georgia and a shifting trend in location to the south. In central Georgia, activity remains about the same with increases reported from a few counties.

The Virginia Division of Forestry reports that southern pine beetle activity has decreased slightly from 1967 levels in the Piedmont and Coastal areas of Virginia. The only marked increases in activity occurred in a three-county area in south central Virginia.

Black turpentine beetle, *Dendroctonus terebrans* (Oliv.), continued to cause losses in disturbed stands throughout the Gulf South but at considerably lower levels than in previous years. The proportion of successful attacks in residual trees was low and restricted to trees severely damaged during logging operations. Chemical control programs were terminated on the National Forests

in Texas and the Kisatchie National Forest in Louisiana.

Summer drought conditions caused an overall increase in black turpentine beetle activity throughout Georgia during 1968. Although large size infestations decreased, an unusually high number of small spots were detected.

Engraver beetles, *Ips* spp. Infestations by three species of engraver beetles—*Ips avulsus* (Eichh.), *I. grandicollis* (Eichh.), and *I. calligraphus* Germ—caused heavy loblolly pine losses over a 120,000-acre area near Camden, Ark. which was severely damaged by hail storms during early May.

Localized epidemic populations of *I. avulsus* were detected in shortleaf pine stands on the northern half of the Holly Springs National Forest in north-central Mississippi.

Late summer outbreaks of *I. avulsus* have caused extensive damage to scattered areas of pine on the Oak Ridge Atomic Energy Commission Reservation. Abnormally hot, dry weather combined with summer thinning operations have contributed to the outbreaks.

A 3-year rainfall deficit has contributed to increased *Ips* spp. activity on the Osceola, Apalachicola, and Ocala National Forests in Florida. Lightning strikes have precipitated most of the spot activity with drought conditions sustaining them. The Florida Forest Service reports that total annual mortality of trees throughout the State increased from 1.5 million in 1967 to 2.4 million in 1968, most of which is attributed to *Ips.* spp. built up in fire-damaged and drought-weakened trees.

I. confusus (LeC.) invaded pinyon pines killed by lightning or girdled by porcupines in the Davis Mountains of western Texas.

Southwestern pine beetle, *Dendroctonus brevicomis* LeC. (*D. barberi* Hopk.). Scattered single-tree infestations of the western pine beetle were detected in ponderosa pine stands near Black Mountain in the Davis Mountains of western Texas.

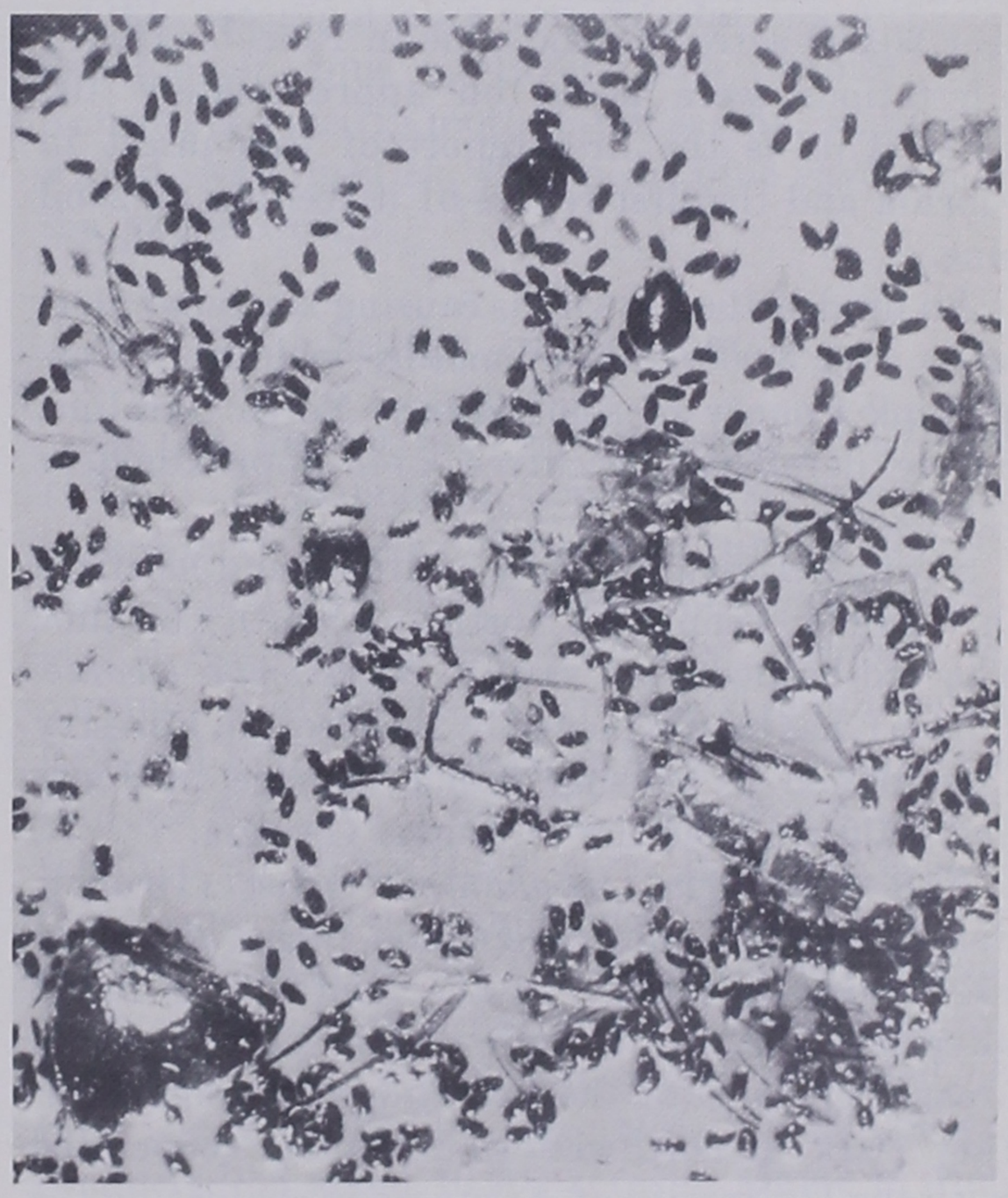
Douglas-fir beetle, *Dendroctonus pseudotsugae* Hopk. Two areas of infestation by Douglas-fir beetle were detected in Douglas-fir stands in the South McKittrick Canyon area of the Guadalupe Mountains in Southwestern Texas. The largest infestation contained over 30 trees with active brood. This is believed to be the first report of this insect in Texas.

Balsam woolly aphid, *Adelges piceae* Ratz. An isolated aphid infestation has been detected for the first time in the Balsam Mountains of North Carolina, an area previously considered free of aphid infestations. The Fraser fir type on Mount Rogers National Recreation Area is now the only major fir type which is still considered free of aphid in the three-State area of North Carolina, Tennessee, and Virginia.

Two new isolated areas of aphid infestations have been detected in the Great Smoky Mountains National Park in North Carolina near Tricorner Knob and on Spruce Mountain.

Plans for suppression of this aphid on Mount Mitchell State Park in North Carolina were canceled as a result of an evaluation that revealed a very low aphid population.

Nantucket pine tip moth, *Rhycionia frustrana* (Comst.). A severe infestation of the Nantucket pine tip moth was detected in young shortleaf pine stands on an area of more than 2,000 acres near



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Motile crawlers of the balsam woolly aphid on portion of a sticky slide trap. The trap is used to detect infestations of this aphid. (Asheville, N.C.)

Clarksville, Tex. Up to 90 percent of the tips were infested on individual trees. Infestations also occurred on young loblolly and shortleaf pines near Shreveport, La.

Elsewhere in the southern and southeastern States, tip moth populations are at moderate to heavy levels in many seed orchards.

Initial results of a cooperative pilot test of the systemic insecticide Thimet to control the Nantucket pine tip moth on the F. H. Claridge State orchard in North Carolina are very encouraging.

Forest tent caterpillar, *Malacosoma disstria* Hbn. Infestations in the hardwood bottomlands of the Atchafalaya River Basin in southern Louisiana declined to low levels during 1968 following several years of moderate to heavy defoliation. Colonies of larvae occurred in sweetgum near Krotz Springs and in Chicot State Park. Light defoliation occurred over a localized area on the Mermentau River in Jefferson Davis and Arcadia Parishes.

Pine sawflies. The Florida Board of Forestry reports a sawfly, *Acantholyda circumcincta* (Klug.), causing light to moderate damage on over 90,000 acres of sand pine in Florida. Heavy infestations were noted on approximately 100 acres. This is the first report of this insect in Florida and the first report of it feeding on sand pine.

An unidentified sawfly is causing scattered mortality over 3,000 acres of mature loblolly in Pasquotank County of southeastern North Carolina. Severe defoliation occurred over approximately 1,000 acres.

Sawfly activity is widely scattered and localized in Virginia, Tennessee, North and South Carolina. The red-headed pine sawfly, *Neodiprion lecontei* (Fitch), has been reported by the Georgia Forestry Commission as causing minor damage in Jones and Baldwin Counties of central Georgia.

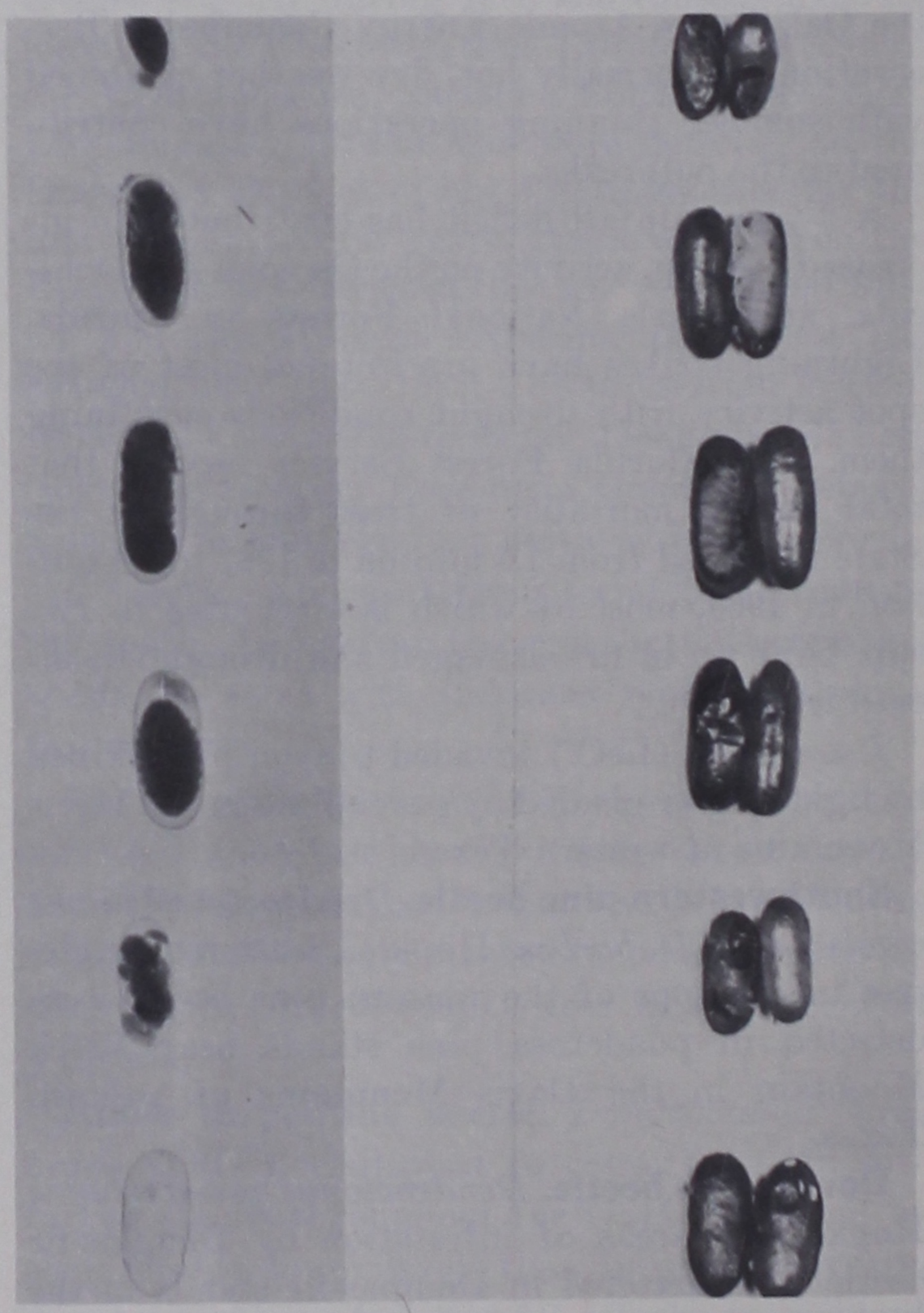
Fall webworm, *Hyphantria cunea* (Drury), defoliated black gum, persimmon, pecan, and other hardwoods over much of the South. This insect adversely affected esthetic values on recreation areas. Personnel of the Pea Ridge National Military Park in northwestern Arkansas cooperated with the University of Arkansas in evaluating the effectiveness of the microbial insecticide *Bacillus thuringiensis* Berliner against this insect. Light to moderate defoliation occurred on the Platt National Park in Oklahoma and the Natchez Trace Parkway in Mississippi. Localized heavy defoliation occurred on persimmon on the Trinity District of the National Forests in Texas.

Other insects. An outbreak of pine colaspis, *Colaspis pini* Barber, occurred on the Francis Marion Seed orchard in South Carolina. Ground application of DDT was used to bring the infestations under control.

Populations of an oak leaf tier, *Croesia semipurpurama* (Kearf.), continued to decline over areas in and adjacent to the James River District of the George Washington National Forest in Virginia.

Defoliation of cypress by a looper, *Anacamptodes* sp., occurred twice during 1968 to the same 10,000 acres in Glades County, Fla.

An epidemic population of walkingstick, *Diapheromera femorata* (Say), caused light to moderate defoliation of red oaks over a 10,000 acre



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X-ray reveals condition of sawfly pupae quickly and accurately. *Left*—radiographs; *Right*—same pupae dissected. Top to bottom: male pupa; female pupa; pre-pupa; single parasite; multiple parasites; and empty pupal case.

area on Winding Stair Mountain in eastern Oklahoma.

The cottonwood leaf beetle, *Chrysomela scripta* F., and the cottonwood twig borer, *Gypsonoma haimbachiana* (Kft.), damaged cottonwood plantations near Echo, La. and on the Delta National Forest, Miss. A budworm, probably *Choristoneura* sp., caused light defoliation of Douglas-fir in the Guadalupe Mountains, Tex. The hickory twig girdler, *Oncideres cingulata* (Say), girdled branches of elm, hickory, and pecan on the Platt National Park, Okla. Deodar weevil, *Pissodes nemorensis*, Germ., killed young loblolly and shortleaf pines in southeast Texas.

NORTHEASTERN STATES [1]

By Robert G. Doerner [2]

Division of Forest Pest Control
Delaware, Ohio

Conditions in Brief

During 1968, forest insect pests continued to damage forest resources in the Northeastern Area. Of the 22 forest pest problems encountered, 14 were related to defoliators.

Spruce budworm populations are on the increase in Minnesota and Maine. A 31,000-acre suppression project may be needed in Minnesota to prevent further damage to the forest resources.

Jack-pine budworm populations remained static in the Lake States, except in lower Michigan. Chemical suppression is being planned on about 2,000 acres in Minnesota and Michigan.

Fall cankerworm and oak leaf tiers caused defoliation in Pennsylvania and New Jersey on over a million acres of oak. New Jersey plans to treat about 67,000 acres in 1969.

Saratoga spittlebug populations are on the increase in Maine, Michigan, Minnesota, and Wisconsin. Suppression is anticipated on 6,000 acres.

Outbreaks of pine tussock moth are recurring in east Minnesota and northeast Wisconsin. Further population increases are expected in 1969.

Hardwood borers are causing estimated annual losses of $2,000,000 in Missouri.

Seed and cone insects damaged about 40 percent of cones in seed production areas.

The forest tent caterpillar is defoliating large acreages of aspen in Minnesota and Michigan.

The saddled prominent was present on 700,000 acres in New York. Further increases are expected in 1969—75,000 acres of valuable beech-maple type may be treated to suppress this pest.

The gypsy moth quarantine line was extended into Pennsylvania for the first time.

Damage by balsam woolly aphid continues in fir stands in Maine, New Hampshire, and Vermont.

An oak leaf roller complex causing dieback was present on 360 square miles in Lower Michigan.

The beech scale has moved into Massachusetts and New York causing mortality to sawtimber-size stands. Suppression is currently limited to protection of high value trees.

Of lesser importance were infestations of the oak skeletonizer, pine engraver, pine tortoise scale, Nantucket pine tip moth, larch sawfly, white-pine weevil, walkingstick, European pine sawfly, and the palmerworm.

Status of Insects

Spruce budworm, *Choristoneura fumiferana* (Clem.). In Minnesota, about 500,00 acres of the spruce-fir type were defoliated in varying degrees. Over 96,000 acres were severely defoliated on Superior National Forest, with tree mortality occurring on small areas previously defoliated in 1966 and 1967. An increase in area and intensity is forecast for 1969. Chemical suppression may be required on about 31,000 acres for protection of State and private lands and National Forest recreational values. In Aroostook County, Maine, the spruce budworm continues to threaten spruce-fir stands with further expansion expected. A pilot test with the new insecticide Sumithion was conducted on about 10,000 acres in Maine in June 1968. The results were not considered satisfactory for operational use. Larvae reduction was less than 50 percent. In southern New York, a small outbreak occurred on Norway and white spruce.

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[1] Includes forested lands in Connecticut, Delaware, Illinois, Indiana, Iowa, Maine, Maryland, Massachusetts, Michigan, Minnesota, Missouri, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, Vermont, West Virginia, and Wisconsin.

[2] Report compiled from information submitted by the Field Representatives at Amherst, Massachusetts; Delaware, Ohio; St. Paul, Minnesota; and State pest control personnel.

Jack-pine budworm, *Choristoneura pinus* Free. Unfavorable weather and lack of primary food lessened the amount of defoliation by this pest in Minnesota. Approximately 36,000 acres were defoliated in Wisconsin with some noticeable tree mortality. The outbreak in Upper Michigan is still extensive but subsiding in localized areas. Surveys indicate static populations are expected in the Lake States, except for an upward trend in Lower Michigan. Suppression efforts in 1968 were limited to pilot testing of promising chemicals in Wisconsin. The only satisfactory results were obtained with Matacil. In 1969, chemical suppression is anticipated on 700 acres by Minnesota Department of Agriculture personnel and on 1,100 acres of the Ottawa National Forest in Michigan.

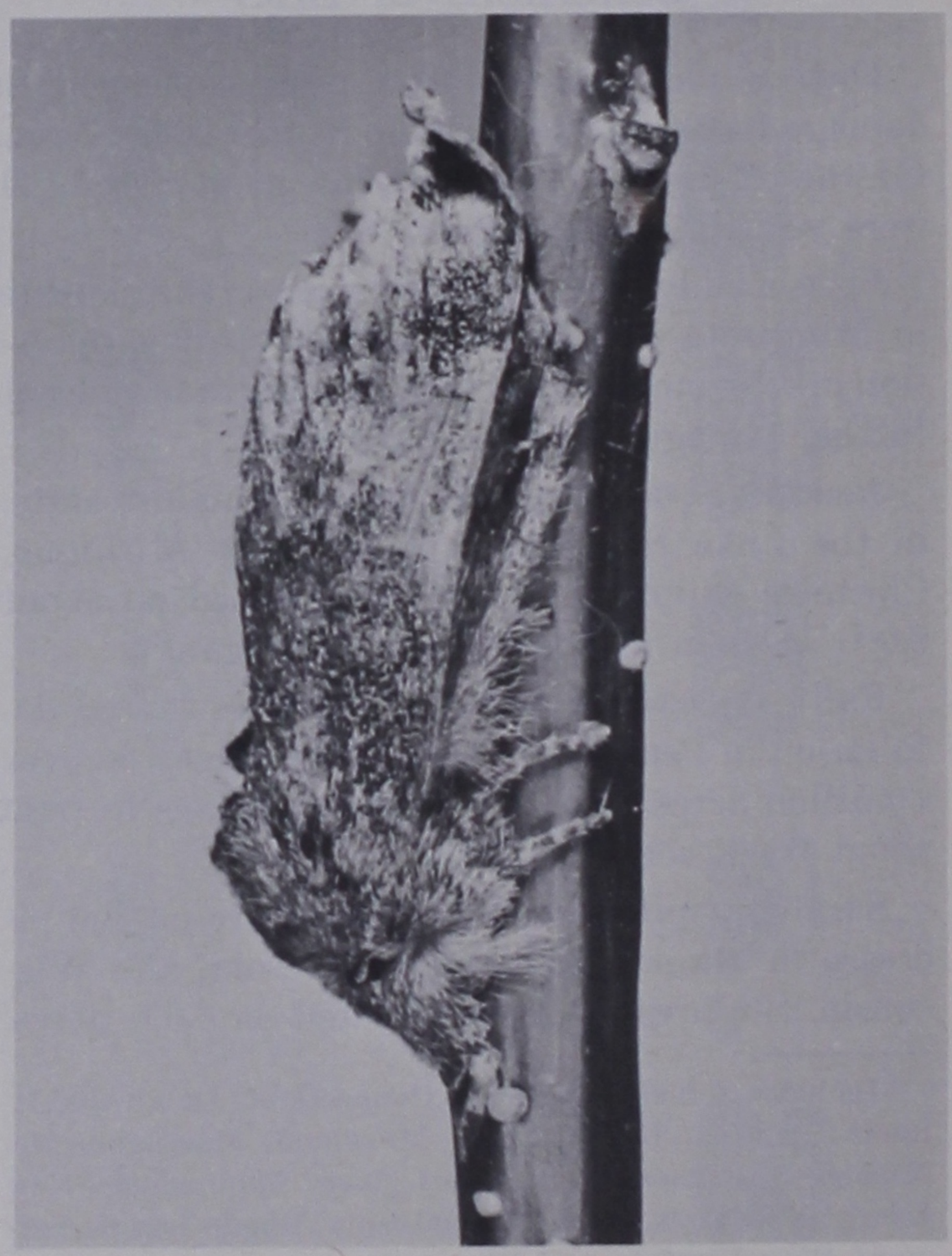
Fall cankerworm, *Alsophila pometaria* (Harris), and a complex of Oak Leaf Tiers, mostly *Croesia albicomana* (Clem.) and *C. semipurpurana* (Kearf.). This group of insects defoliated about 600,000 acres of oak in New Jersey, 35,0000 acres in West Virginia, and 500,000 acres in Pennsylvania.

Previous epidemic populations of fall cankerworm in Pennsylvania resulted in tree mortality on about 43,000 acres in 1968. Small infestations were reported from Michigan and Wisconsin. Defoliation remained about the same in Maine, was scattered in Indiana, and subsided in New York. The 1969 population forecast is down for Pennsylvania, static for Michigan and Wisconsin, but increasing for the other States. West Virginia expects about 175,000 acres to be defoliated. Aerial application of one pound carbaryl per acre by State agencies in 1968 was about 95 percent effective on 1,500 acres in Pennsylvania and 6,500 acres in New Jersey. New Jersey plans a similar treatment on 67,000 acres in 1969.

Saddled prominent, *Heterocampa guttivitta* (Wlk.). This insect pest was responsible for defoliating approximately 700,000 acres in New York, 40,000 acres in Pennsylvania, 30,000 acres in Massachusetts, and about 900 acres in northeastern Wisconsin. Mature larval populations in Pennsylvania and in Upper Michigan were greatly reduced by a viral disease. However, population increase can be expected in some areas of New York in 1969. New York State Conservation Department personnel are planning to use chemicals to suppress this pest on about 75,000 acres of beech and maple that are valued for syrup production and recreation.

Forest tent caterpillar, *Malacosoma disstria* Hbn. Widespread feeding activity by this insect was noted on 3,000,000 acres in Minnesota, 250,000 acres in Michigan, 6,000 acres in Illinois. Scattered feeding was observed in southern Ohio and moderate feeding in eastern West Virginia, Massachusetts, and New Hampshire. No virus occurrence was reported. The population trend is upward for Minnesota, Michigan, New Hampshire, and West Virginia.

Hardwood borers, *Goes* spp., *Enapholodes rufulus* (Hald.), *Prionoxystus robiniae* (Peck). Oak species from Maryland to Missouri are permanently damaged by larvae feeding under the bark and through the wood. Surveys for trends and other evaluations that might enable the initiation of suppressive measures have not yet been developed. A $2,000,000 annual loss is estimated for Missouri.



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Adult male of the saddled prominent, *Heterocampa guttivitta*. (Amherst, Mass.)

Seed and cone insects. Insects, mostly from the genera *Conophthorus*, *Dioryctria* and *Eucosma*, infest about 40 percent of cones collected annually from shortleaf, loblolly, and red pine seed production areas in Missouri, Illinois, and the Lake States. This damage has been reasonably static over the last 5 years.

Pine tussock moth, *Dasychira plagiata* (Wlk.). Defoliation of jack pine occurred on 20,000 acres in eastern Minnesota and on 3,000 acres in northwestern Wisconsin. An increase in populations is expected in 1969.

Beech scale, *Cryptococcus fagi* (Baer.). In association with the fungus *Nectria coccinea*, Pers. var. *faginata* Lohman, Wats. & Ayers, the scale has moved into Massachusetts and New York killing sawtimber-size beech. Mortality is occurring throughout other New England States. Although the population is static, the high level of infestation may practically eliminate larger trees in a few years. No suppression is being carried out except in recreation and other high value areas.

An oak leaf roller complex, *Archips*, spp. Defoliation was noted on most of the red oaks in a 360-square-mile area in northeastern Lower Michigan. Dieback of oak was reported from these areas having repeated defoliation. Populations of this *Archips* group are expected to remain static.

Palmerworm, *Dichomeris ligulella* Hbn. Although this insect is not often found in outbreak status, it caused light to moderate defoliation on 750,000 acres of oak type in north central and southern Ohio. Scarlet oak in several counties of southern West Virginia were reported as severely defoliated. Population trend is unknown, due largely to lack of biological information.

Saratoga spittlebug, *Aphrophora saratogensis* (Fitch). An increasing amount of damage was evident throughout the Lake States and, after a long absence, in Maine. Extensive damage to 5,000 acres was recorded on the Huron National Forest in Michigan. Populations are expected to increase in all these States. Satisfactory control was carried out on 1,000 acres in Maine and on 1,900 acres in Wisconsin and Upper Michigan using ½—1 pound Malathion per acre. Control is planned for 500 acres in Maine and for 5,500 acres of National Forest land in Michigan and Wisconsin.

White-pine weevil, *Pissodes strobi* (Peck). Heavy damage to white pine and Norway spruce occurred in Maine, New Hampshire, Vermont, and New York. Weeviling was common in open-grown stands of white pine and jack pine in Lake States. Light damage was reported from Indiana, Ohio, Maryland, and Pennsylvania. An upward trend is expected in northern New England in 1969 with no change in other States. About 300 acres were treated in New York. Maine Forest Service employees expect to treat some plantations in 1969.

Balsam woolly aphid, *Adelges piceae* Ratz. Damage from this pest has been limited to balsam fir stands in the northern New England States. The infestation in Maine covers 8,000 acres, in New Hampshire, 3,000 acres, and in Vermont 6,000 acres. Aphid populations are expected to remain the same except for increases in localized areas.

Oak skeletonizer, *Bucculatrix ainsliella* Murt. Heavy defoliation occurred on thousands of acres of oak type in Maine, New Hampshire, Vermont, Massachusetts, and New York. Scattered oak defoliation was reported from southern Wisconsin. Population increases that occurred in 1968 are expected to continue in 1969 unless unfavorable weather conditions occur.

Gypsy moth, *Porthetria dispar* (L.). Despite efforts to confine infestations to the northeastern United States, gypsy moth quarantine lines had to be extended into Pennsylvania for the first time. The pest is now present in 17 eastern counties of the State. Substantial population increases have occurred in New York, New Jersey, Maine, and New Hampshire with further increases expected in 1969. Sevin was used effectively on more than 100,000 acres in New York and over 56,000 acres in Pennsylvania. About 2.3 million adults of the egg parasite, *Ooencyrtus kuwanai* (Howard), were released in infested areas by Pennsylvania Department of Agriculture employees in an attempt to check populations.

Larch sawfly, *Pristiphora erichsonii* (Htg.). Defoliation occurred throughout 1968 but this perennial pest caused little measurable damage. Populations decreased in Pennsylvania, remained at high outbreak numbers in Maryland, and were static in New England. A small suppression project, ground-spraying of 100 acres, was undertaken by the Maryland Department of Forests and Parks.

European pine sawfly, *Neodiprion sertifer* (Geoff.). Moderate to heavy defoliation occurred

in Pennsylvania Christmas tree plantings. Ohio, Indiana, Illinois, and lower New England reported light to moderate scattered infestations. Populations should remain static in 1969 except for a decrease in Ohio. In Pennsylvania, private landowners treated 300 acres to control sawfly populations.

Walkingstick, *Diapheromera femorata* (Say). Severe defoliation was observed on 2,500 acres of oak in northeastern Wisconsin, and limited feeding was found in the north central part of the State. Walkingstick populations are expected to increase in 1969.

Nantucket pine tip moth, *Rhyacionia frustrana* (Comst.). Light to moderate damage occurred on shortleaf pine throughout southeastern Missouri. Scattered light damage is reported from Indiana and Pennsylvania. Populations were down in Pennsylvania and static in other States. One small suppression project was completed in Missouri.

Pine engraver, *Ips pini* (Say). Scattered outbreaks causing tree killing were noted on shortleaf pine in Missouri, on white pine in West Virginia, and on jack pine in the Lake States. Pine engraver invasion apparently began on trees weakened by other insect attacks or from mechanical damage. No population changes are expected.

Pine tortoise scale, *Toumeyella numismaticum* (P.&M.). Severe infestations occurred on Virginia and other hard pines in southern Pennsylvania. Damage was heavy on smaller trees. Local infestations were reported from Michigan, Minnesota, and Wisconsin. No population changes are predicted. A small Christmas tree planting was treated in Wisconsin to control this scale.

Maple bark scale, *Cryptococcus williamsi* (K.&H.) This potentially serious pest of sugar maple was found in scattered locations throughout Vermont and New Hampshire. The possibility it may be associated with *Nectria* spp. is under investigation. Although not clearly established, populations appear to be static at a low level.

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